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- MILITARY TECHNOLOGY • CORE i7 870 • CPU ROUNDUP •
- R.U.S.E. • BLIZZCON 2009 •

NEW



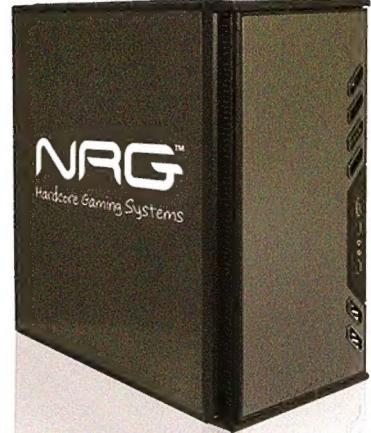
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# EDHEAD

## Game on

We changed a few things last issue, and we're changing a few things again this issue...

But, before the howls of protest at Atomic suddenly becoming a gaming mag, think about what Atomic's always been. Alternately, think about what founding editor Ben Mansill said back in the editorial of issue 1:

*"Turning your PC into a high performance box is only half the fun – what you do with your new improved beast is, really, the point of it all. Which is why we talk lots and lots about games."*

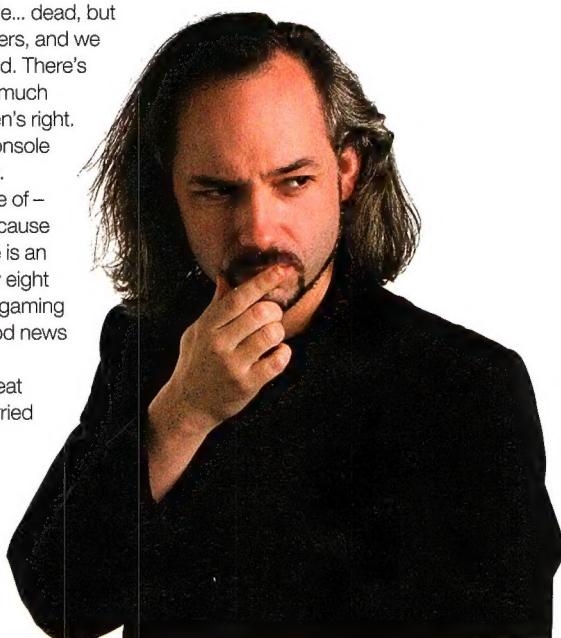
Atomic's always had gaming in its pedigree, and it always will – we're just making it a little bit more obvious is all. Oh, and while we're looking that first, mighty mission statement, here's another gem:

*"A good game is good game whether it be PC, Dreamcast or PS2."*

Okay, so they might be a little... dead, but the point remains – we're gamers, and we game where the gaming's good. There's always a lot of fuss about 'too much console' content, but really, Ben's right. So let me say right now, the console games and articles are staying.

In fact, you'll be getting more of – more of all kinds of games, because the other big change this issue is an increased page count. It's only eight pages – tiny, really – but it's all gaming content: reviews, previews, mod news and more.

And, of course, the other great thing about that is if you're worried we're focusing away from hardware and technology... we're not! We've kept all of that great content, and in fact we'll be running more of it in some cases. Our new improved X-Ray section



is case in point. And boy is this month's a ripper: Jake Carroll's outdone himself in terms of hardcore tech, and we're sure this is the first of many great articles from the forum's own zebra.

Anyway, if you really do have an issue with the changes, look at it this way – between the Power to the PC Tour (p104), and our upcoming Borderlands event (p33), you'll have lots of chances to catch up with me and give me a piece of your mind.

See you then.

David Hollingworth  
[dhollingworth@atomicmpc.com.au](mailto:dhollingworth@atomicmpc.com.au)  
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ISSUE

## LOGIN

Gearbox  
All the best new stuff.

X-Ray  
Enter the tape silo...

I/O  
Our monthly helpdesk.

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Enter the world of hardened PCs and fly-by-wire aircraft!  
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## atomicCREW

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We cannot accept responsibility for unsolicited copy and stress that it may take some time for a reply relating to these submissions to be sent out.  
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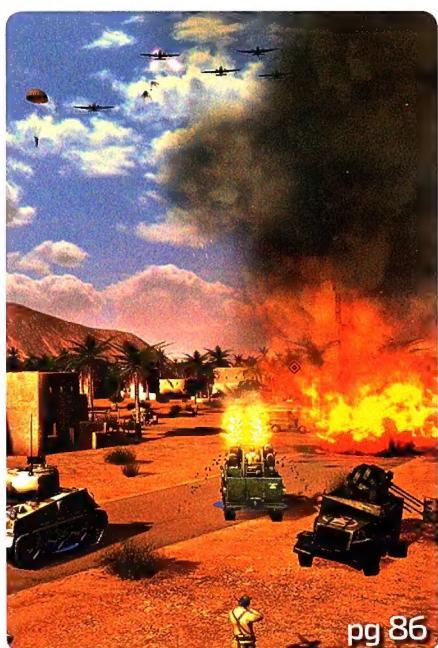
ENGINE ROOM: R.U.S.E.

 Find out what makes this  
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# NASA satellite broadcasts 461GB of data daily

The lunar probe's got some new old-school tech.



The whole point of sending a hunk of metal into space to observe those things we're not close enough to see clearly is to have enough data to justify the expense - but one of the problems that NASA had run into was actually getting the information back to Earth.

Thankfully for us the scientists and engineers at NASA looked back to the past for a brand-new design, basing a new transmitter on older vacuum-tube technology as opposed to the current transistor-based (just like older radios).

Called the Travelling Wave Tube Amplifier, it's a 13-inch tube built by L-3 Communications Electron Technologies that uses electrodes to create high-

powered microwave radiation - ideal for transmitting data over long distances without loss of quality.

The system works so well that they've been able to record speeds of up to 100Mbps, roughly equivalent to cabled networking on the ground, which give the lunar probe the capability to send an amazing 461GB of pictures, video and measurements recorded.

This also has potential use in geostationary satellites such as the communication and GPS systems orbiting the Earth, as a significantly increased bandwidth available would allow greater amounts of data - and therefore a wider range of uses.

## Slimmer, cheaper, sexier PS3 coming in September

[cockney accent] Size - SLASHED! Price - SLASHED! Power consumption - VERY SLASHED! It's all got to go in the new PlayStation 3![/cockney accent]

Cheaper, slimmer, sexier.

That's the buzz around Sony's announcement of a new version of its PS3 console, which will be available early next month. And it's a buzz that's pretty hard to fault.

With the slimmer form factor - Sony's boffins have trimmed the internals, including PSU and cooling, down by about two-thirds - comes a much more competitive price: \$499 in hard Aussie dollars.

At the same time, the PS3's system software will be updated across the board to version 3.00, bringing a host of UI improvements.

Other improvements include a 120GB hard drive (over the current model's 80GB HDD), lighter weight, and lower power consumption. The new PS3 uses two-thirds less power, in fact, and this also improves the unit's overall cooling, which means less fans, which means quieter operation. Bonus.

The great thing about the price drop (and the current model will drop to \$US299, assuming you can find one) is that this places the PS3 in line with good Blu-ray players. Considering you get one of those as well, the new unit is pretty compelling just on that front. Treat it as a player that can also run the odd game, as well as access services like the awesome VidZone, and we're kinda hooked.

And, of course, rest assured we're annoying Sony about sending us one to tear apart and photograph the hell out of. We want to see this sexy new internal design, and we're sure you do too.



It's Post of the Month time again, and there's been a range of great stuff on the forums: cool tech, gaming and important life lessons. So who's got the best of the bunch? Who's going to walk away with a shiny CyberSnipa Stinger mouse courtesy of Digital Warehouse World?

Big woots for **michael.jenkin!** He had some very sage words of photographic repair advice in this wonderful thread: <http://forums.atomicmpc.com.au/index.php?showtopic=19929&st=0&p=397177>

And of course there's smaller runners-up woots for these awesome Atomicans!

**Foods** engages in some witty timetravel insulting with himself: <http://forums.atomicmpc.com.au/index.php?showtopic=2553&st=2280&p=402919&entry402919>

**mudg3** and **Giro** give a hand here: <http://forums.atomicmpc.com.au/index.php?showtopic=19995&st=0>

And, finally, we have another top contender from **michael.jenkin**, as he talks about tech

qualifications and what they mean to him compared to real experience: <http://forums.atomicmpc.com.au/index.php?showtopic=19330&st=0&p=398563#entry398563>





# GTA IV: The Ballad of Gay Tony

Experience Liberty City from new heights – figuratively and literally.

We got to spend a little time with the latest content expansion for GTA IV, and we liked what we saw. The Ballad of Gay Tony casts you as Luis Lopez, the go-to guy for club owner Gay Tony.

You move in the highest levels of society and crime in Liberty City, and some of your jobs include stealing helicopters to impress the father of a notorious kingpin, knocking off mobsters so you can take over their hockey teams, and all kinds of rather... serious crimes.

There's also a mess of new guns, like the automatic shotgun with explosive shells and the fully automatic SAW machine gun. And a lot of parachuting...



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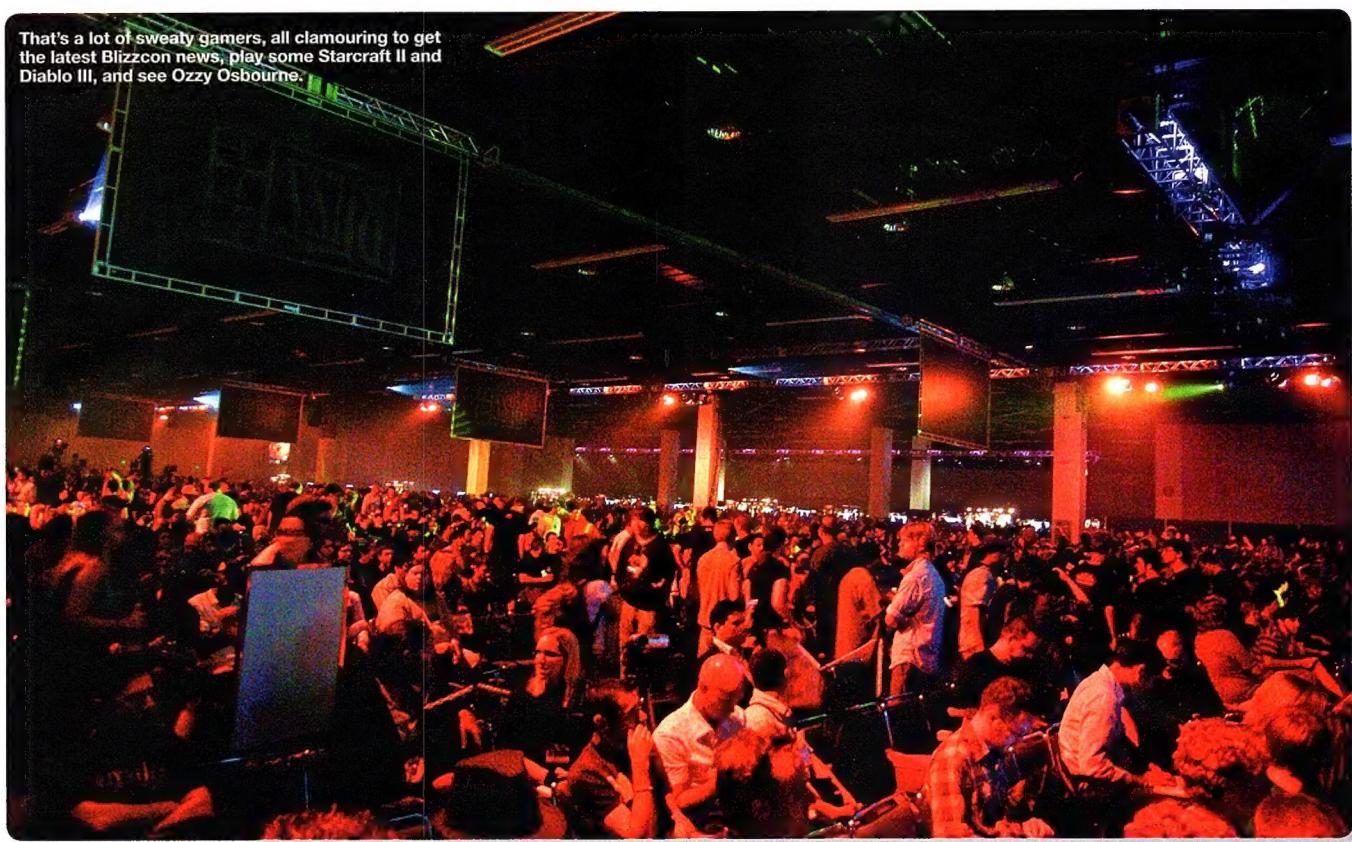
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That's a lot of sweaty gamers, all clamouring to get the latest Blizzcon news, play some Starcraft II and Diablo III, and see Ozzy Osbourne.



# BlizzCon 2009

Liz Skuthorpe checks out Blizzard's biggest day.

**A**tomic has been to BlizzCon 2009 and had a pretty good time all-round! This year, gamers had the chance to play on over 1700 machines loaded up with the latest playable versions of Diablo III, StarCraft II and the just announced World of Warcraft expansion.

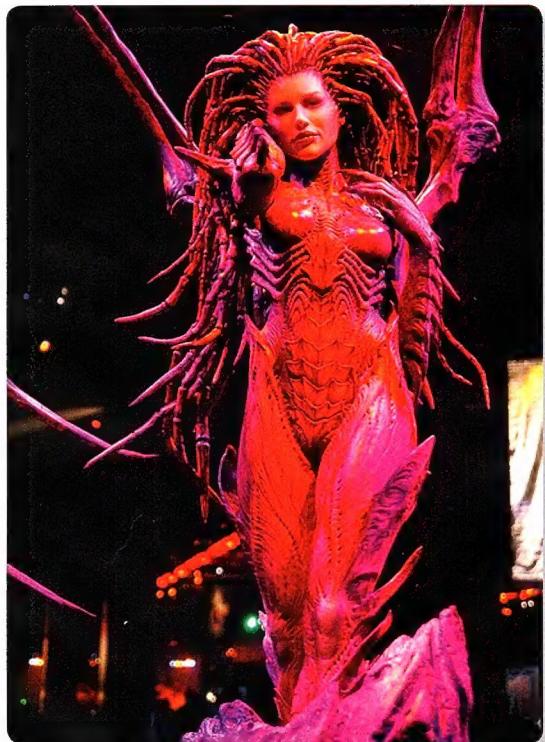
As usual the halls were huge, dark and filled with gamers, merchandise and some of Blizzard's coolest statues; this year we saw a replica of the Orc Rider and Wolf that stands outside Blizzard Headquarters. But by far the biggest news of the convention was the reveal on World of Warcraft's third expansion, the aptly named Cataclysm. This expansion of the MMO will drastically alter the landscape of the world and include massive redesigns of world zones, the introduction of two new playable races and brand new levelling areas for the updated level cap.

Diablo III developers revealed their latest character class; the Monk. This fighting-game styled character will utilise skill chain combos and a flashy martial arts style to kung-fu fight his way to heavenly glory.

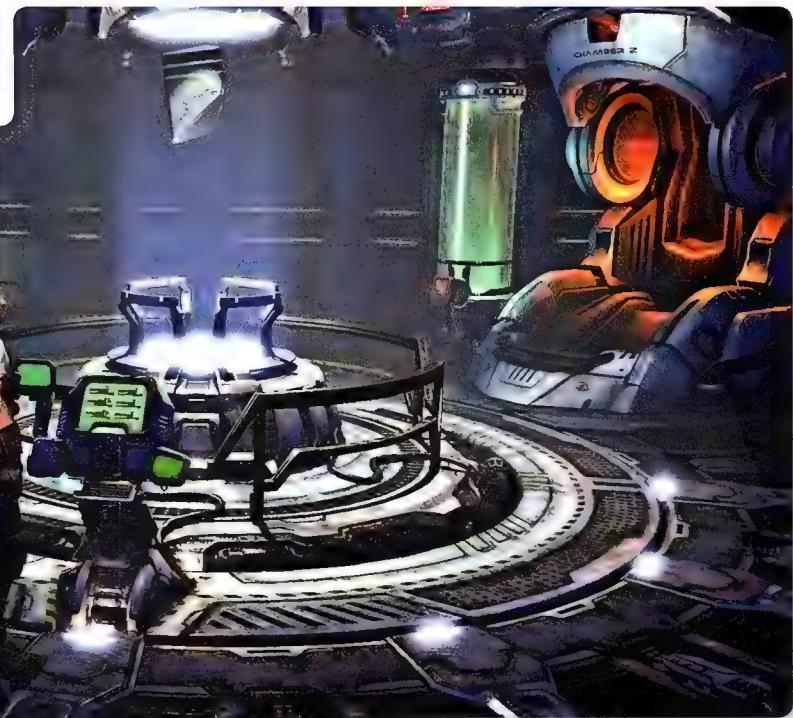
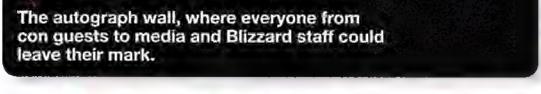
StarCraft II players were introduced to the latest gameplay updates and to an updated Battle.net service. The new service, which will be launched with StarCraft (hopefully in 2010) should feature an improved matchmaking service, league ladders, as well as some big changes to the communication channels in the service. Players can look forward to the implementation of Real ID systems to track friends and fellow gamers across Blizzard games.

If all that wasn't enough to keep BlizzCon occupied the closing ceremony featured not only Jay Mohr (making another return to the show) and Level 80 Elite Tauren Chieftain (soon to be renamed The Artists formally Known as Level 80 Elite Tauren Chieftain [or TAKA L80 ETC]) but the Prince of Darkness himself Ozzy Osbourne! Arthas didn't show, so we're guessing that Ozzy's title is safe.

For more in depth information on all the BlizzCon news, check out all our online coverage at [www.atomicmpc.com.au/Topic/154086,blizzcon-2009.aspx](http://www.atomicmpc.com.au/Topic/154086,blizzcon-2009.aspx)



Kerrigan, Starcraft's buggy femme fatale, in all her chitinous glory. Is it wrong to feel... attracted?



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## 1. Zerg Messenger Bag

Price TBC Supplier Razer Website [www2.razerzone.com](http://www2.razerzone.com)

We gamers are a tribal lot, always more than happy to wear our hearts - and our gaming allegiances - on our sleeve. If you're a Starcraft fan, you'll be able to do that and more thanks to the new gear on the way from Razer, makers of more or less fine gamer gear for a good part of this millennium.

The first item in Razer's new Starcraft 2 range is a pretty neat, Zerg-themed messenger bag. The fabric is tear-resistant and waterproof, there are compartments for all kinds of devices, and it's amply padded. And it's got sexy bug-lover Kerrigan on the front. Hmm...

## 2. ioSafe Solo 500GB

Price \$299 Supplier ioSafe Website [www.iosafe.com.au](http://www.iosafe.com.au)

Solid, capacious and reliable data storage is becoming more important in the home, and therefore there's a tonne of new products flooding the market – but few of them can handle an actual flood. Unlike the ioSafe Solo, which is one damn tough drive.

This drive is almost literally disaster-proof – it can survive fires, days of immersion in fresh or salt water, and feels like it can handle a drop onto a concrete floor. It's rugged, heavy, and it will absolutely ensure that no natural disaster will ever take away your pr0n.

And that's the kind of peace of mind I think we could all use a little more of.

## 3. Sony BDVE800W system

Price \$1699 Supplier Sony Website [www.sony.com.au](http://www.sony.com.au)

Blu-ray's still yet to make a real penetration into the AV market, but there's no denying that once you've seen the crystal clarity of the picture, or heard the robust sound it has to offer, there's no going back. Trust us, if you like cinema or TV, you've got to go Blu-ray.

And Sony's latest all-in-one system is a helluva stylish way to go Blu-ray!

Apart from the player itself, and the iPod dock, HD audio decoding and 5.1 speaker system the BDVE800W features wireless rear speakers. Wireless! If there's one curse in the modern home it's the giant runs of dust-bunny gathering cables. Oh, callooh callay, blessed wireless!

Now, all we need is a wireless system that can make me martinis, and my home will be perfect...

## 4. PROBOX

Price \$439 Supplier Anyware Website [www.anyware.com.au](http://www.anyware.com.au)

This really should be called the All-in-one-Box.

The PROBOX pretty much does everything else that your TV player or playback devices can't. It can handle time-scheduled recordings via an in-browser interface, as well as EPG-based recording to make sure that schedule changes don't mean missing your favourite episodes of Inspector Rex. And ad-skipping lets you enjoy shows as they were meant to be enjoyed – with odd pauses in between acts and no time to go to the toilet.

And if you do miss that all important episode of everyone's favourite canine detective, you can always... well, let's just say that the PROBOX handles torrents pretty well too. Finally, for the ultimate in filesharing, you can set up your BOX as an FTP server. Neato.

## 5. Speedblack

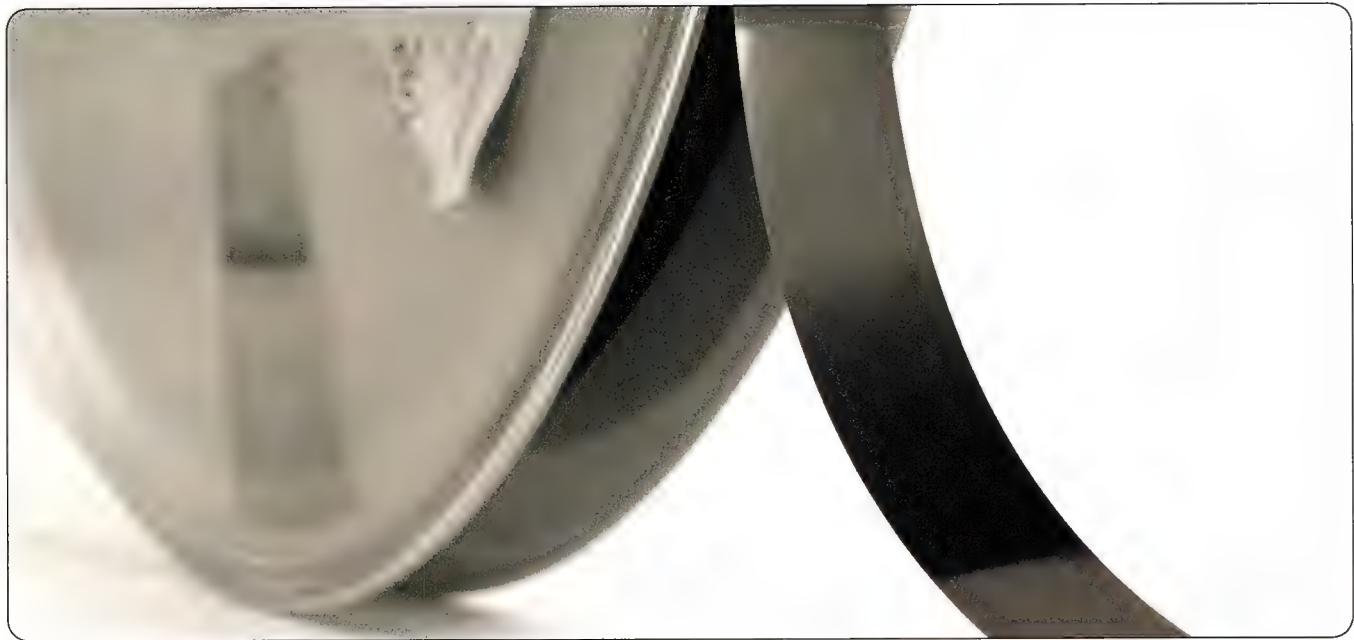
Price \$299 Supplier Digital World Warehouse

Website [www.dww.net.au](http://www.dww.net.au)

There's few things more awkward than sitting in the lounge, trying to balance a steering wheel on your lap, or the necessity to set up and take down your steering wheel in front of your PC. The clamping, the screwing, the getting the cats out of the way... but no more.

The Speedblack is an "electronic steering wheel universal stand system". Yeah, sounds impressive, and it's a neat idea. You just attach your wheel and pedals once, and adjust the unit to your height (or lack thereof) and you're ready to race.

Even more conveniently, it folds away even with controllers attached, so your girlfriend can stop picking on you for leaving your Logitech steering wheel clamped to the coffee table. Or the cat.



# All that is old, is new again

Jake Carroll gets his storage on, and messes about with giant robot tape monsters.

**A**s an Atomic reader, you'll probably have a few Terabytes of storage just sitting around the house, in the lounge-box, or a Windows Home Server. Hell, you might even harbour an epic ZFS media box, for the really hardcore crowd. Storage is sexy. This month, we're going to show you a dark, cavernous storage place that most people never tread. We're taking a tour through the large-scale tape silo.



Reel to Reel style NOVA data storage mechanisms for mass storage, circa 1985, capable of no more than 350MB of storage capacity, at several hundred kilograms.

## Why Tape?

Here we are, in the era of SATA-Rev 3 (if they can get the ASICs right, and not destroy every first born motherboard), SAS-Gen 2 and SSD, and we're talking about cranky old tape. Crazy. Tape however, lives in the lofty heights of the big-computing world, right up there with the fastest SSD or 15k RPM FC-AL disk. Tape is used in the very largest enterprise facilities and financial institutions, as well as scientific organisations for a few clear reasons.

1. It's dense. So damn dense. 2TB uncompressed on a tape currently. It matches

hard disk density one for one, and then some. Tape media is about to hit with 3.2TB compressed capacity. Yeah.

2. It's fast. So damn fast. You can haul > 240MB/sec constant from a single tape drive and fibre channel interface. This is faster than the sustained streaming rate of any singular current mechanical hard disk, without exception.
3. It's cold. When it isn't being used, it isn't spinning, and it's not creating heat. Environmental green points plus-plus.
4. Tape-stored data is data at rest. When tape is not in use, it's sitting still, practically impervious to 'destruction' at the mercy of a crashing RAID array or out of control processes.



July, 2008. The movie Get Smart mysteriously houses a high end tape silo in the background. Capable of storing 70PB of data, the SL8500 is the largest tape library in the world, used in the vast majority of Fortune 500 companies and research facilities such as the Large Hadron Collider (LHC).

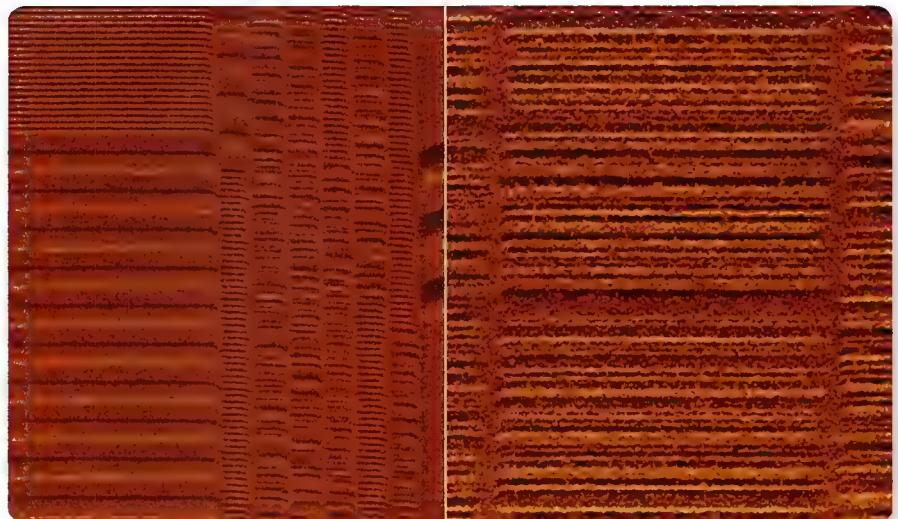
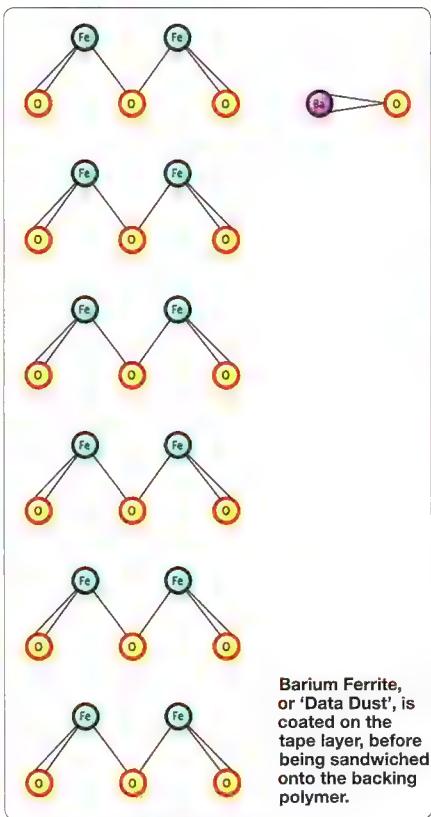


**Microphotograph of a read/write head (0.3 mm).**  
The lithographically defined copper coil of the write transducer is orange in colour.

5. Tape is the mightiest of audit-trails. Every time you log into your Internet banking system, or swipe your EFTPOS card, or burn the plastic on that expensive new Corei7 box, you're on tape. If you've done it, it's on tape somewhere. Policies and compliance procedures such as the Sarbanes-Oxley act rely upon it. Entire empires are built on the fact that, 'It's safe in the silo, somewhere'.

## Then, now and somewhere in the middle

Once upon a time (probably in black and white movies), you'd see enormous tape devices, 'reel to reel' spooling to read data into 'mainframe' computers.



Left, the pits from a zoomed out view, right, 10x magnification, where we can see the individual pits and grooves that represent data or 'on/off' signals.

As time has gone on, economies of scale have changed. Data growth has exploded. As such, tape storage mechanisms have become radically faster and larger, with many times the density.

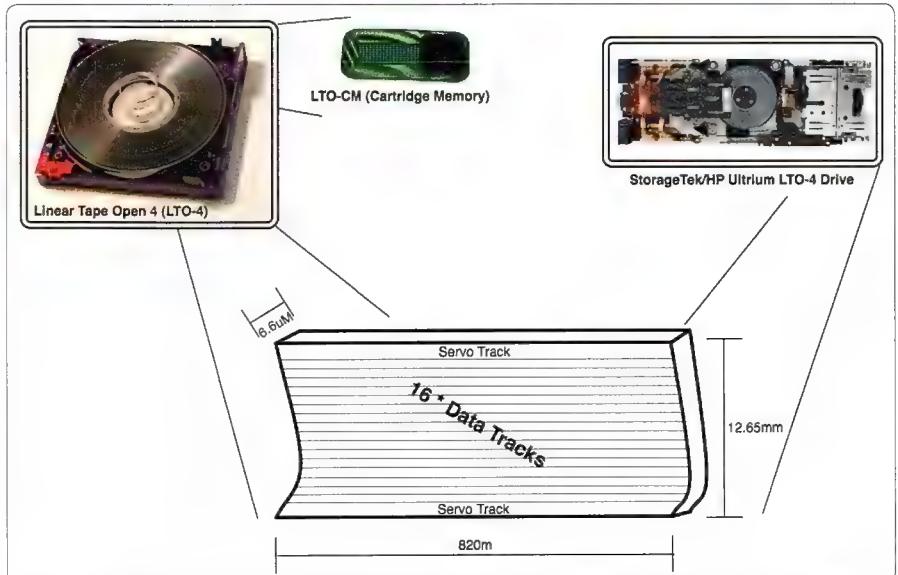
Tape itself has changed a great deal in its makeup over the years, from the chemical treatment it uses, to the physical compounds that make the electrically sensitive polymer that allow a tape to 'store' data. Tape in general uses a few simple principles to 'store' data.

1. A tiny, powerful magnet is used to align data on a path in the form of 0s and 1s.
2. A write strategy to figure out the best way to write the data onto a medium so that it can be most efficiently placed, and then, subsequently read back.
3. An Application Specific Integrated Circuit (ASIC) is responsible for taking these reads and writes,

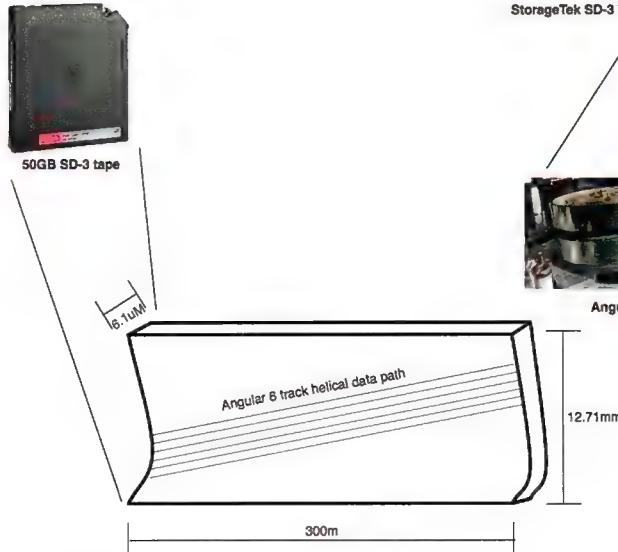
and putting them somewhere useful on the device, before it physically hits the tape head.

4. A tape head is used to read and write the data.
5. A buffer is used to contain data and create a streaming layer between the data source and the tape drive.

The tape layer and the chemical makeup is darker voodoo, entirely. These days, on most media types the density of the magnetic particle, and thus, how much data it can hold, is governed by the ability of the manufacturers (of which there are only two or three at the top tier) to shrink the fabrication and chemical coating process. The chemicals used for current generation T10000B (Sun/StorageTek) and LTO4 (Linear Tape Open, Imation/StorageTek/Mitsubishi etc) use acicular ferromagnetic particles coupled with tabular ferromagnetic hexagonal barium ferrite.



**Basic LTO media structure, consisting of two servo tracks, 16 data tracks, and a drive capable of writing against 16 tracks simultaneously. The effect of the track multiple is a quicker seek time to data and less passes to fill a tape. The LTO CM is 8192 bytes and is written via a small RF device inside the drive. It is used to label tape/keep track of tape names, keep media condition information, and tell other devices about the generation or revision of media in the tape fabrication.**



**Helical scan media and drive structure, consisting of a 300m tape, of similar dimensions to a linear tape, six angular data track paths and an angular read/write head, inside the SD-3 tape drive. The angular path coupled with head movement creates a helix like imprint, allowing data density and speed of operation to be increased.**



Barium Ferrite is a crystalline structure that has a hexagonal outer formation at the lattice level. Under a microscope, aligned by a magnetic read/write head attached to a servo, we see here the surface of 'bit pits' on LTO4 media.

The bit-pits in LTO4 media have an average density of around 43.03 billion bits per square centimeter (43.03 billion bits/cm<sup>2</sup>).

Awesome, but how does the tape actually get data transferred onto it with accuracy, to begin with? The answer resides in a recently significantly exploited quantum mechanical theory known as Giant Magneto Resistance or GMR.

## Quantum cool bits

GMR is a set of effects observed in tape-like environments (thin film) where the structures are such that they have an alternating ferromagnetic and nonmagnetic layer (like a zebra stripe). When the effect takes place, we see a significant reduction in electrical resistance. As a direct result of lower resistance, we see lower magnetic scattering. This means the field of magnetic force is less wide and distributed. Why this is so important in the read/write heads of both hard disks and tape drives is because the more accurate one can place a magnetic field, the more data one can put 'next to' the next bit of data,



The robotics prop that the gripper sits on is typically made of multi-layered carbon fibre. It needs to be extremely strong, and light.

and as a continuation from that, the faster this process can be carried out.

When the read/write head 'almost' contacts the tape with its magnetic field to change the 'shape' of pits or tracks, the way in which it aligns data and how the tape passes underneath the head differs from media type to media type.

## Linear and Helical scan

Linear tape is laid out using 'data bands' across the width of the media. In the case of LTO-4 specification, we see 16 of these bands. These bands are written in both directions of spin, so 'rewinding' a tape and 'fast forwarding' a tape to transport for a certain block offset is a relative concept. If a tape is at block offset 0x66210A and it needs to get to 0x33402, it will seek backwards, not simply rewind, then fast forward back to the offset requested.

Helical read/writes were for a long time en-vogue for their perceived benefits in write/access time. The concept of helical scan is as the name implies. Tape wraps around the read/write head at an angle, leaving the magnetic 'imprint' in a pattern similar to that of a flattened helix. The idea behind this is to rotate the tape head at extremely high speed, but have the physical tape media moving across it slowly. To achieve density of data throughput (and thus, bandwidth), the only practical way to do this was at an 'angle' with multiple paths of 'heads' per tape.

Over time, helical-scan has fallen out of favour, in comparison to the linear methods, based upon cost of manufacture, mechanical problems due to more strenuous forces on the tape head and reducing performance gains next to linear methods and technological advances. As of this year, the majority of the world's data storage volume shipment from the tape vendors resides in linear tape, with only a few helical supporters, such as Tandberg Data, still having active drives in service or development.

## Can I put wheat in it?

As with many things in computing, scale becomes an issue, as time marches on. For



An engineer assembling a large-scale storage silo. Each slot is capable of holding numerous media types. Large silos typically hold anywhere from 500 to 10,000 physical tapes.

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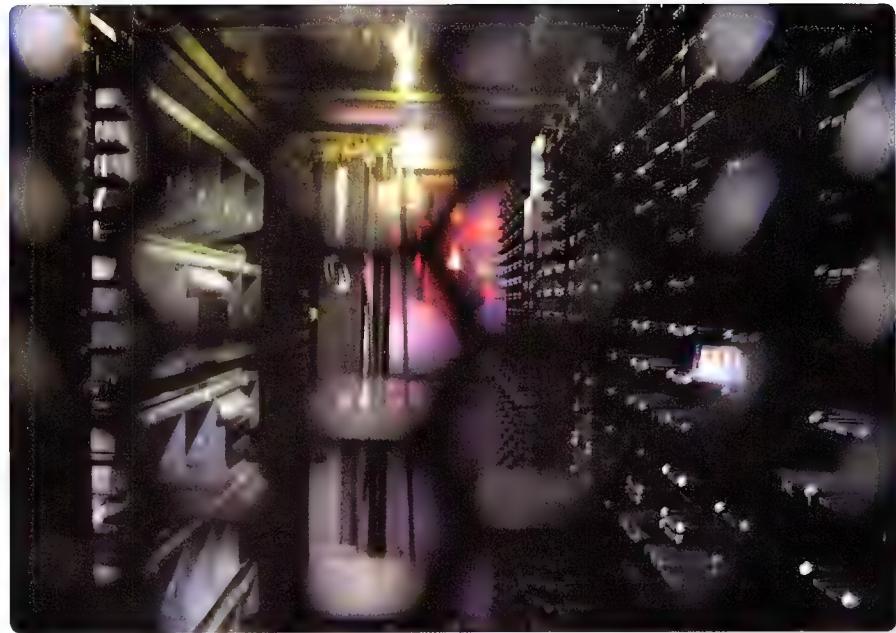




The Drive Array.

the last two decades, we've worried about the scale of every aspect of computing. RAM slots, BUS bandwidth, CPU cache density, aerial sector density, and transistor count on the GPU. Everything. We've also been worrying about how to keep all that archive data at rest. Enter the tape library, affectionately referred to as 'the silo'. The tape silo has several major components.

1. Physical storage area
2. Robot
3. Cap
4. Drive array
5. Host interface
6. System controllers



## Physical storage Area

This is where tapes are physically 'stored' when not in use. These storage ports, or 'slots' as they are generically referred to, resemble a pigeonhole in a cupboard.

## Robot

Perhaps the most technologically advanced part of the silo, the tape robot is controlled (generally speaking) via SCSI commands, telling the device where to go to pick up, set down, which drive to insert media into, and which way to bend.

Enterprise robots consist of a guide or drive train, can move in three dimensions (X, Y, Z), have a laser or bar code LED reader and have the ability to articulate the tape movement head (gripper) in multiple orientations.

## Cap

The cap is the section of the library in which one can load, or unload tape. Sometimes referred to as the mail-slot, it is a means to get media into, and out of the library.

## Drive Array

The Drive Array, where physical tape drives are stored. Pictured, a T10000B series drive, with dual outputs for tape connectivity over Fibre Channel.

## System Controllers

The robot's SCSI table, and how it is controlled can be dumped out of system firmware (the operating system running on the controller of the library itself) and used as a reference to make the robots do your bidding.

There is a reason these robots are behind a significant cage. Traveling in excess of 80Km/hr when in full operation, at a weight of 7.5kg per bot/gripper, if this were to hit a human, there would be carnage, at best.

Hopefully this month, we've demystified the creepy world that the tape silo inhabits, and you now have the urge to go and find a tape drive and pull it apart. Go on. Void the warranty. Put it back together. Spray 0s and 1s everywhere in a blinding glow of multi-gigabit glory. Show it what you're made of.

Command sequence for library	Hex Code on SCSI bus
Init Element Status	0x07
Move Medium from Cap to Drive	0xA5
Prevent/Allow Medium Removal	0x1E
Report LUN's	0xA0
Send Volume of Tape Tag	0xB6

A non-exhaustive list of the commands sent down the SCSI link to the tape silo system controllers by a host, to work with the robotic operations.



'The System Controllers, where all the love happens. These connections control hosts access to the robot arms, and thus, the ability of a host to 'talk' to the library. Oftentimes running small embedded Linux distributions, they are effectively tiny computers, driving enormous devices.'

# INPUTOUTPUT

Dan Rutter brings the answers to your questions like no-one else can.



## I/O OF THE MONTH

### As accurately depicted in Stargate SG-1

**I** Computers use electricity to run. The logic gates are made of silicon doped with other stuff, but they run on electricity, just like every historical one including the old analogue computers.

Is it possible for a research lab to build a fully functional CPU that runs on light, rather than electricity, with logic gates made of 'fancyglass' that transmit laser beams? Would they still have the 10GHz internal switching limit that silicon CPUs currently have?

Alan Podjursky

**O** You're talking about 'photonic computing', which exists, but is in its early stages.

One of the big early photonic efforts was to create all-optical networking hardware, so when you're moving slabs of data around via optic fibre you don't have to do it 'electro-optically'. That means converting your photonic data into electrons, then processing it in conventional computers, then converting it back into photons.

We've got some all-optical network devices now, and their throughput is gigantic – processing speed is indeed a big advantage of photonics. But all-optical network hardware does very specialised

jobs, like wavelength-division multiplexing and demultiplexing. That's where different colours of light, each carrying its own data stream, are combined and sent down one fibre, and then split up again at the other end so that colour-blind electro-optical hardware doesn't get confused.

There are also all-optical signal amplifiers, which mean long-haul fibres don't need performance-sapping electro-optical signal regenerators any more.

These are very important technologies, but they're a long way from general computation.

We've had 'photonic transistors' since 1989, and even photonic integrated circuits, but they're miserably simple compared with the electronic versions. Current desktop CPUs are pushing into billion-transistor territory; as I write this, an optical IC with a hundred components on it is a big one.

At the moment, optical chips have to include several different kinds of components just to generate signals and move them around. This means you can't make an optical IC with one single manufacturing process, like you can if you're making a silicon chip with little more than zillions of plain transistors on it.

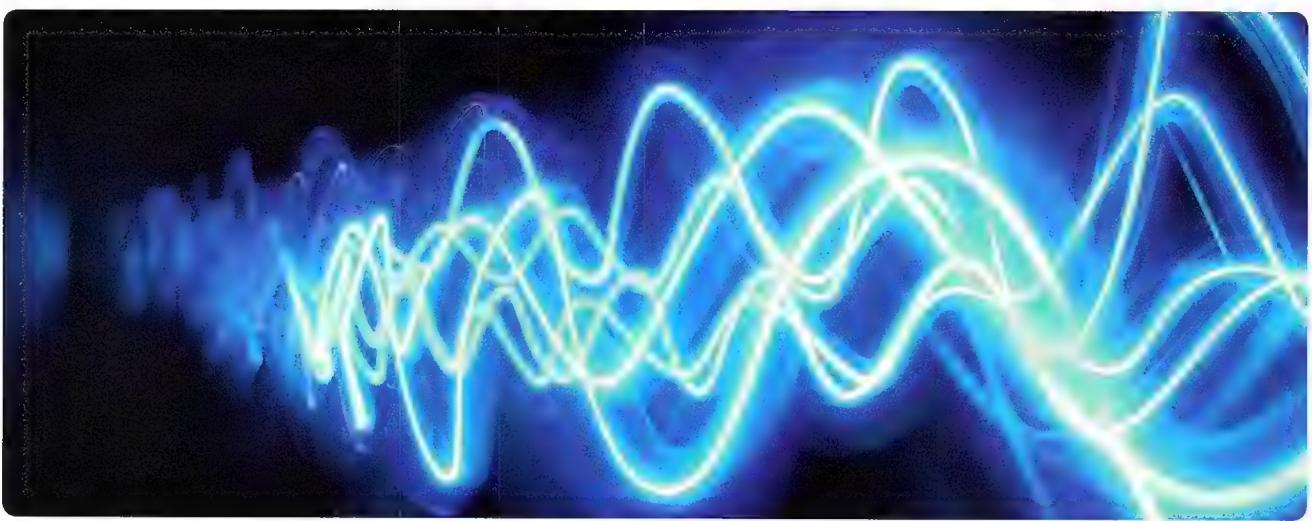
There are several non-electronic ways to process optical signals. Micro-electro-mechanical, 'MEMS' systems, for instance, which can bounce light off minuscule mirrors; that's how DLP

**I/O OTM**

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projectors work. There's also thermo-optics, using steam bubbles in a fluid to influence the light, and liquid-crystal systems, which use variants of existing LCD technology to block, pass and polarise light. It's possible that something like this, which isn't electronic but isn't really photonic either, will be the closest we ever get to a real 'optical computer'.

(Analogue computers, by the way, weren't all electrical. An analogue computer is anything that uses continuously-changeable physical properties to represent data. So a slide-rule, for instance, is an analogue computer. There have also been several 'water computers', which process data via water flowing between different reservoirs at different rates. The most notable of those was the 'MONIAC' back in 1949, which modelled the economy of the UK in a far more comprehensible way than any other information system of the time.)



## Not Enough = Far Too Much

**I** I have just built a new box (Gigabyte EX58-Extreme, i7 CPU, Sapphire 4850, 3GB Adata triple-channel RAM, Windows XP SP3 32-bit) and have hit a snag.

Some of my software refuses to run due to 'not enough memory'.

A bit of a Google led me to a thread suggesting the removal of one of the RAM modules because of some problem XP has with 3GB. I gave it a go and sure enough everything works now.

WTF?!

Thing is, now I only have 2GB, no triple-channel and a spare RAM stick that makes a pretty poor paperweight!

The software in question is good old Ski Resort Tycoon. The error is a pop-up window:

I have since put the full 3GB back in, and the problem is back.

Is there any way around this that doesn't involve installing Vista? (Do I need XP64, 4GB of RAM...?)

Russ

**O** 'Out of memory' errors can be hard to figure out, but the error box was a dead giveaway this time.

It's not a Windows error, but one generated by Ski Resort Tycoon itself. (The wording is different from a Windows error, but the clincher is that the word 'available' is misspelled. Say what you like about Microsoft, they do at least usually spell their errors correctly.)

So what this probably is, is a dumb free-memory checker that can't believe that anybody could have more than 2GB of memory. It's like the installer errors I talk about in this old I/O column: [www.dansdata.com/i0067.htm](http://www.dansdata.com/i0067.htm)

The first thing to try when old games don't work is the Compatibility options in the Properties for the game. If that doesn't help – and it often doesn't – your next stop should be Microsoft Virtual PC, a free package that lets you make a virtualised 'client' PC within your own Windows 'host' PC. The client PC can have pretty much whatever basic hardware specs you want, up to the actual specs of the computer it's running on.

As I write this, Microsoft's site has a mania for guiding you to the Windows 7 version of Virtual PC; you'll need an earlier version to be able to use anything but Windows 7 as the host operating system. The previous version is Virtual PC 2007 Service Pack 1:

<http://tinyurl.com/287FX8>

<http://tinyurl.com/53EQBQ>

The virtual PC works just like a real one – you can install any OS that you can install on a 'real' PC, and then do anything with that OS that the host PC can handle. It'll be slower than running stuff directly on the host computer, so you probably don't want to try playing Crysis on the virtual PC. But you certainly can play older, less demanding games like Ski Resort Tycoon, on a virtual computer that you set up with only 1GB of RAM, plus whatever other limitations may be necessary. People also use virtual PCs to try out Linux, test possibly-malicious software, and so on. You can even play DOS games using Virtual PC, but DOSBox is a better solution for that.



Virtual PC allows you to be annoyed by several versions of Windows at once!

## Warning: May lead to steampunk

**I** My desktop is in an old beige full-tower AOpen case with three case fans, but an otherwise drab exterior. So in Atomic style I was thinking I would make it better by adding stuff.

I should point out before I have my subscription cancelled for not being Atomic enough by even making this statement, that this is my third home PC; it's only doing print server, Squid and web server duties. My main PC is shiny black, which alone makes it faster in my opinion.

Anyway my idea seems so simple there must be something wrong with it so your input would be appreciated. I planned to get two panel meters like Jaycar's #QP5020, and wire them onto a four-pin Molex plug off the power supply. One across the red wire to the black wire, and the other meter across the yellow wire to the other black wire.

Will this work? And more importantly, will this cause the magic smoke to escape from my motherboard/power supply sending them to silicon heaven? It would be a bonus too if they provide any useful information. Like if I want to add a sixth hard drive I need a new power supply.

Mark Brindley

**O** Yep, it'll work fine. Panel meters like these pretty much do what it says on the tin, and their large input impedance – 20 kilohms, for the ones you're considering – means they add a trivial load to any power supply that isn't expecting to run a wristwatch. Connect one of these panel meters to a AA alkaline and the needle will slide down from a fresh 1.6 to a worn-out 0.8 volts over the course of, oh, I'd bet on between six and seven years.

Even quite large analogue voltmeters have very high input impedance. The bigger the meter the more power it'll need to move its needle against the force of the return spring, but a PC power supply won't notice even a huge voltmeter. So feel free to hunt around eBay for antique meters from power-stations or battleships. If it's a DC meter with an appropriate voltage range, it should work. And yes, analogue meters like this can provide useful diagnostic info – but unless you get meters with narrow voltage ranges, you're going to have to look pretty closely.

(Digital panel meters are easier to read, and have high input impedance too, but are of course less fun. They also need a separate power-supply wire, to feed them usually -5V at not very many millamps.)

Current meters, not that you asked, are a bit trickier. They're physically similar to voltmeters, with pretty high input impedance. But you have to put an ammeter in series with a load to measure current through the circuit. If you put a high-impedance device in series with a load that has much lower impedance, the load won't work anymore.

So instead, you connect an ammeter in parallel with a carefully calibrated low-value resistor called a 'shunt' (which is likely to have rather lower resistance per length than the wire in the rest of the circuit...), and put the shunt in series with the load, so the ammeter's measuring the (very small) voltage across the shunt. This is how the current range on a multimeter works; if you take the meter apart, you can often see the shunt, which may be some thick copper wire with a calibrated notch in it.

Jaycar has an info sheet about this:

<http://tinyurl.com/KJQ TUH>



The specs on the side of this shunt, plus Ohm's Law, tell us that it's a 0.0006-ohm resistor.

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# Convergence

**It's all coming together, and it's getting Ashton Mills very excited.**

**A**round the turn of the millennium convergence was the term de jour, representing awesome technologies coming together to create uber-devices of the future.

It was mostly rhetoric about phones having cameras. But it was a big idea back then, because cameras and phones were two separate devices and the idea of merging them was crazy mad.

They had no idea. Today everything is converged. Your news is a paper and website, your website is text and videos, your videos are mashups and hotlinks, your hotlinks are social

creates new possibilities while obsoleting others, and you can scream and shout all you want but you have only two choices: adapt, or die off. The younger generation tends to adapt, and so younger and more agile companies get it right first. Take YouTube, for example, as young and as in-touch with the wave as you can get.

And while Google doesn't quite know what to do with YouTube, it bought it because the company recognised the future staring it right in the face. YouTube is now the second largest search engine in the world with an estimated audience well over 100 million globally. That's

of the iceberg at the cusp of the beginning. We have no idea what it will look like five years from now, let alone ten or more. But it's exciting, because we're in the flow, in touch with the technology, and a part of the convergence that's shaping society and our lives. We're not just in it, it's happening through us, as the rise of user-driven content overtakes traditional business and communication models (how many sites do you visit more for the forums than the site?) and the Facebooks, Flickr, Twitters, YouTubes of this world turn on our lives with the most authentic of content, putting them on display like never before. 

**While the industrial revolution shaped the world over the period of a century, the information revolution has done it in a third of the time.**

networking and geolocation, and you... you're in the center, and everywhere else, all at once.

Our society is in the midst of convergence as technology tears down old paradigms like 'distribution' (hello RIAA, MPAA and other dinosaurs) and sets up new ones no one had any idea existed until the moment they popped into your phone-come-web-portal, like the titillation that is Twitter. Murdoch wants to charge for news in the States because he's still living in a world where the transaction is the purchase of a product, instead of the ownership of eyes that it's actually becoming. Go ahead, charge for the news, and watch everyone go to the free news sites and then watch as they thank you for the custom, selling more and more advertising thanks to the greatly increased viewers.

Technology is a stern mistress and doesn't care for what worked before, because it's already old news, pardon the pun. It occurs,

five times the population of Australia.

It highlights another level of convergence: of our communication. Social media is becoming the number one means that people communicate with, re-defining how, when, and where we connect with others. In turn this will shape our society, our business, our economics, and ultimately our country. And much, much faster than you think.

It has been said that necessity is the mother of invention, but I tend to think it's the other way around – invention is the mother of necessity. Witness teenage girls falling down manholes while twittering, and politicians with Facebook pages. While the industrial revolution shaped the world over the period of a century, the information revolution has done this in a third of the time so far.

Of the convergence of our lives and the tools we use, what we've seen so far is just the tip

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# RUGGEDISED

All it takes to disable most home computers and laptops is a spilled cup of coffee, a curious toddler or a build-up of dust – so how do computers manage when they need to function in hot, dusty or wet environments? **Phil Hartup** investigates the computers that go where angels fear to tread...

**H**ome computers have a luxurious existence in the grand scheme of things. They might have to work hard, or be forced to undergo constant unnecessary maintenance (and when they blue-screen they're usually subjected to tirades of verbal abuse that would make Gordon Ramsay cry), but that's about as bad as it gets. Computers for the armed forces, emergency services or people who work outdoors have a much tougher time; they need to be able to survive adverse conditions that would have your average overclocked gaming rig reaching for the white flag.

## How rugged are you?

Ordinarily, computers object to wet conditions, don't like dirt, crash if they run hot for too long and fly apart if you drop them. This doesn't bode well for any machine intended for use out of doors, and

therefore a different type of computer is required, in the form of 'rugged computers'.

There are two main types of rugged, or ruggedised, machines. The first and most common type is a computer that has been built from the ground up to operate in hostile environments. The second type is a standard computer that has been toughened up. Wearing a flak vest doesn't make a person a soldier, and the same can be said for merely attaching padded or reinforced plates to a laptop casing – ruggedisation is a process that's best implemented at the very start.

The level to which a system has been ruggedised can vary, but in order for buyers to know what they are getting there are various standards at which systems are rated. No one standard covers all aspects of ruggedisation – the ability to withstand shock, and resist dirt, water or other unwanted substances accessing the PC are all governed by different standards.



## Mil-Spec: the coolest spec of all

The most common standard by which a ruggedised computer system is rated for shock resistance and other more general environmental problems is the MIL-STD-810, or the military standard, often abbreviated to Mil-Spec. The standards for this are updated every few years and include tests for such diverse conditions as humidity, exposure to fungi, gunfire vibration, acceleration and even changes in air pressure.

The second standard by which ruggedised computers are assessed is called the International Protection Rating, or IP Code. IP Codes are international standards that assess how well a piece of technology is protected against the intrusion of undesirables such as water, dirt and prying fingers. IP Codes are followed by a two-digit number that details the level to which a system is protected. The first digit describes the type of elements that are able to penetrate the casing – a zero denotes that the system's critical components are effectively exposed to foreign objects, while a top mark of six means that the system is completely impenetrable even to dust and effectively airtight. Most ruggedised systems will rate a five on this scale, which means that although they aren't airtight, they're well protected against dust.

The second digit of an IP Code refers to the system's level of waterproofing. Again zero means that there's no protection whatsoever, with higher numbers reflecting the system's

ability to withstand drips, sprays or splashes of increasing magnitude. The scale goes up to eight, which means that the system can be immersed in water over 1m deep. Very few fully ruggedised systems for general use will rate the highest IP Code. A 54 rating, meaning mostly dust-proof and splash-resistant, is considered effectively weatherproof.

Previously, IP Codes also covered resistance to impact, but this is now assessed by a separate standard known as IK Codes. Set out by European Standard 62262, IK Codes range from IK00 to IK10, with equipment that is able to withstand higher energy impacts receiving a higher rating. At IK10, a piece of kit can survive being hit with a 5kg steel object striking its surface with 20 joules of energy.

A further measurement of ruggedness, arguably the toughest of all, is the TEMPEST certification, although this is seldom encountered by civilians. A classified standard, the TEMPEST assessment deals with how resistant equipment is to electromagnetic eavesdropping. During normal operation, electronic devices (in particular computers and screens) emit electromagnetic radiation. Theoretically, this can be remotely intercepted and used to read small but critical parts of the operation of the computer, or the data being processed by the system.

TEMPEST concerns originally arose during the cold war, with TEMPEST being used as a meaningless codeword to cover any kind of 'compromising radiation' that electrical equipment might emit (entertainingly discussed in a partially declassified NSA document

from the 1960s found at [www.nsa.gov/public\\_info/\\_files/cryptologic\\_spectrum/tempest.pdf](http://www.nsa.gov/public_info/_files/cryptologic_spectrum/tempest.pdf)). As technology has evolved, so has TEMPEST screening, and it was recently suggested that it is now an acronym for 'Telecommunications Electronics Material Protected from Emanating Spurious Transmissions'. As TEMPEST is a classified standard, it's hard to find any detailed information about it, but the highest level of TEMPEST goes by the catch name of NATO SDIP-27 Level A.

To achieve this certification, a system must have complete electromagnetic shielding. For instance, this may mean that the cables have to be coated in copper foil or the components might be earthed to the chassis. It's possible to find a few companies on the Web selling TEMPEST equipment (such as [www.sst.ws/category.php?slid=6](http://www.sst.ws/category.php?slid=6)), ranging from screens to PCs to printers, and these will often be based upon standard consumer equipment, upgraded and altered to meet the relevant standard.

## From flower power to Jack Bauer

It's one thing knowing what qualities your PC needs to have to be able to attain an IP Code rating, but another matter achieving it. The differences between a Mil-Spec laptop and a standard model start at the most basic level with the casing. Some of Panasonic's Toughbook laptops use magnesium alloy cases, which are much stronger than standard plastic casing. As a tougher casing won't warp or flex too much when it hits the ground after a fall, it will protect more fragile internal components from damage. This strength is of great benefit but it doesn't completely eliminate the



The Dassault D3R was a battlefield computer built in 1994, and weighed in at 10kg. Ruggedisation technology and colour schemes have come a long way since then.

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The hard disk access, USB ports and power coupling are all sealed on the Toughbook, and as there are no fans, there's no need for any grilles.



problems of shock damage from a fall.

To prevent shock damage, a system needs shock absorbers in much the same way as a car needs suspension – the force of any impact needs to be dissipated before it's transferred to vital components; failing that, vital components need to be braced to handle it. The toughness of a metal casing is very important, but it isn't the end of the issue for a rugged PC, as they also feature rubber corners on the case to reduce the shock of impact. The effect of this is that rather than landing like a brick and taking all the energy of the impact in one hit, a rugged PC will bounce.

Hard disks are one area in which advances originally developed for rugged technology have made their way into the mainstream. Originally, hard disks had to be manually instructed by the user to 'park' the read heads if the PC was about to be moved, in order to protect the drive from damage. This now happens automatically

components. Systems ruggedised to an IP Code of 54 or better have sealed keyboards and touchpads. This means not only that any spills won't drip into the main body of your system, but also that they won't penetrate the workings of your keyboard, either. Water is bad enough but sticky or acidic liquids can corrode connections or leave a residue that causes problems even when dry, so keeping them out is the best idea.

We'd really like to see something like this on gaming gear – there's nothing worse than V to gum up your sexy gaming keyboard!

Rugged laptops often include screens covered by a sealed layer that protects it from scratches and impact as well as rain and dust. These screens are often also geared towards working out of doors, which means that unlike regular screens, that are close to unreadable in direct sunlight, these displays can be viewed anywhere. As well as sealing screens and

## The toughness of a metal casing is very important, but it isn't the end of the issue for a rugged PC...

when the drive powers down, but many laptop hard disks also park the heads when a motion sensor detects the laptop has been dropped. Hard disks can be further protected through the use of a shock-absorbent mounting.

In order to gain a high IP Code and protect against the ingress of liquids, laptop designers need to pay special attention to the keyboard, as this frequently covers important system

touchpads, sockets on the outside of the casing have sealable covers and all the screws have gaskets sealing them shut against liquids.

One area in which computers are susceptible to dust is their fan vents, but most ruggedised systems with a high IP Code have neither vents nor fans. Cooling methods for ruggedised systems vary, but one of the advantages of a metal casing is that it can be incorporated into

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the cooling system. Heat from the CPU and other hot components is distributed evenly around the casing using heatpipes. Commercial PC manufacturers have experimented with this approach - most notably Zalman, with its TNN300 and TNN500 passively cooled cases, and some netbooks, such as Sony's P-series, also get away with it thanks to their low-power Atom CPUs.

There are, of course, drawbacks to making a PC tough and electromagnetically secure. The extra care and attention to weak points impacts on price - Pioneer's Dreambook Tough, featured on our cover, is fully ruggedised, meets the latest revision of the MIL-STD-810

over recent years aren't that apparent to the average consumer. Tougher and more resilient computers have started to feature in devices where before they would have been considered too fragile or unreliable to be used.

The most obvious example of how today's tougher systems are making their presence felt is in the military. Some of the first computers built, such as the Colossus at Bletchley Park, were built with military use in mind and the military has always been close to the cutting edge when it comes to pushing the boundaries for computer use. The implementation of computers close to or actually on the battlefield however brings with it problems of its own. In

## **...the military has always been close to the cutting edge when it comes to pushing boundaries for computer use.**

spec, and is IP54-compliant. It also costs about \$5,000, and its specs are relatively conservative. It has an Intel Pentium-M, 512MB of RAM and a 14.1in 1,024 x 768 screen. While you could buy half a dozen or more similarly performing laptops for the same price, if you used them in tough conditions they wouldn't last long, and it shows the premium that ruggedised designs can demand. The second drawback of rugged technology is its size and weight - the CF-30 weighs nearly 4kg, and its casing makes it chunky.

But then again, it does look a lot like something you'd expect to see the Colonial Marines using in *Aliens*. Kinda cool, huh?

### **Boldly going**

Ruggedised laptops are all well and good but the real strides made in computer hardiness

an office or home environment there are viruses, spyware and the occasional energy drink spill to worry about. Under combat conditions, the threats become all the more dangerous, if a little less sophisticated.

Many computers used in combat are embedded into vehicles; this gives them the advantage of a stable mounting that will afford a degree of protection from the elements. It exposes them to damage from vibrations, though, and this may cause components to become loose over time. This can be countered by shock-absorbent mountings, but a more effective method is to reduce the amount of components used in the first place. Streamlining a computer to make it more rugged is a valid design approach, so it's obvious the military is interested in Thin Client Technology. In this kind of design, the system

is a simple, low-power unit. It's then connected to a Fat Client, which acts as a server for multiple systems, providing files, data and even processing power for many client computers. Think of it as military cloud computing.

While in certain situations, computers benefit from keeping things simple, there are advantages to more complex systems, and modern fighter planes such as the F-22 and the Eurofighter are excellent examples of this. Almost all modern aircraft are fly-by-wire (FBW) designs, which means that they're effectively flown by computers relaying the actions of the pilot to the plane's control surfaces.

What makes the Eurofighter special is that the computers have to do much more than simply interpret what the pilot does. This is because the Eurofighter is a 'relaxed stability' design - this makes it more manoeuvrable, but it has unstable flight characteristics, so much so that a human pilot simply can't fly it unaided. Sensors keep tabs on the Eurofighter while it's in flight and these feed information into the FBW computers; these computers then make constant, minute adjustments to the control surfaces of the plane. The US F-117A Nighthawk is another example of a 'relaxed stability' design - in this case, the use of computer systems to keep it in the air enables it to utilise a distinctive shape which makes it difficult for radar systems to detect.

The Eurofighter has four FBW computers, each with eight 32-bit Motorola 68020 CPUs (a design dating from the mid-1980s, versions of which were originally used in the Apple Macintosh II, as well as Amiga's CD32 console).



The Getac PS535F isn't quite as sexy as the iPhone.

# DANGEROUS

Computers, like vampires and tragic heroes, have their weaknesses. Whatever purpose your PC is built for, the following five threats are to be avoided like the plague.

## WATER

Water getting into the guts of an electronic system is usually enough to take it down faster than the Wicked Witch of the West but without all the wailing. Water conducts electricity, so a circuit immersed in water is in effect covered in extra circuit pathways that it wasn't designed to have. If your computer does get wet, you need to cut the power as quickly as possible, and then leave it to thoroughly dry out.

## STATIC

Static electricity doesn't seem too scary when it's doing fun things such as making balloons stick to walls or zapping your girlfriend, but in computing terms, it's lethal. Although a typical electrostatic discharge (ESD) that can be unwittingly caused by a human isn't enough to hurt anything living, computers are designed to handle electricity in very precise quantities and blasting different levels of voltage through the system can be instantly catastrophic. You can quite easily minimise the danger from static damage by using a static bracelet (which grounds you) when touching internal components. Alternately, touch something metallic outside of your machine before digging around in your system.

## SHOCK

Shock damage is the trauma a system suffers when it falls. If you drop a light object such as a mobile phone or an MP3 player, you'll be unlucky to break it, but a laptop, especially a big one, can take an extremely nasty hit from a fall. The most vulnerable component to shock damage is a hard drive, particularly if it's accessing files when the shock occurs. Even fully ruggedised systems can struggle to deal with being dropped from a fairly low height – ironically, the greater toughness of these systems increases the weight, which in turn means that they hit the ground with more force. As with static electricity, the best defence against shock damage from falling or vibration is to make sure that you don't expose your system to it in the first place. In vehicles, this can be accomplished by providing mountings for the system that keep it locked in place, while with portable systems, problems can be mitigated by using a reinforced laptop bag.

## DIRT

Sand, dirt, dust and other small particles aren't immediate threats to computer systems in the same way as shock and water, but they're still a potent menace. The most obvious way in which dirt will hamper a system is by interfering with moving parts or connection points. Fans and optical drive bays can suffer too, as can USB ports and power couplings. One particularly tricky irritant to deal with is sand. In a desert

environment, sand will find its way into almost anything. The only solution to particle problems is to try to keep your system and its surroundings clean, and use filters for fans.

## HEAT

We all know that the heat caused by components is a problem, but the problems of cooling can be exacerbated if your surroundings are warm. While the mathematics behind even elementary thermodynamics is incredibly daunting, the actual practicalities of cooling are much simpler. The speed at which an item loses heat to the air is determined by the difference in temperatures, so air at 0°C is going to absorb much more heat from a hot object (say, at 80°C) than air at 40°C. Hot components warm the air around them, so you have to keep the air moving, and the speed at which the air moves makes a difference too. In situations where systems have to be sealed, ambient heat is a much greater problem. Water or other liquid-based cooling can help, as it can be used to transfer heat very effectively, but it's a point-cooling method, so while it's fine for cooling a specific component (such as a CPU), it won't help to cool a room full of servers. Generally, large amounts of heat require a variety of approaches – air-conditioning for the room, liquid-cooling for certain components, and the use of fans.

The use of older CPUs in aircraft (and spacecraft) is a well-documented practice, owing to the fact that the older the design, the more likely the inevitable bugs will have been worked out. Reliability trumps processing power when lives are on the line.

That said, computers still go wrong. Although computerised weapons platforms going crazy and deciding to blow up their creators is the stuff of which movies are made (very often really bad ones like *Stealth*), the reality is that what to the average PC user might just be a blue-screen of death, on board a plane it could be a situation requiring a change of underpants or worse.

Computer crashes of this type have been a rare, yet notable, problem with the F-22 Raptor fighter. The most bizarre incident (which thankfully resulted in no loss of life) was during a flight made by six Raptors to Okinawa in 2007, which saw all six aircraft suffer multiple system crashes when crossing the 180th meridian of longitude. Although the aircraft were able to continue to fly and landed safely, all six lost navigation and communication abilities as a result of the crashes and had to be escorted home. This event shows the importance of using separate systems for critical components, but more importantly, it shows that even in multibillion dollar defence projects, you can still

find the same sort of bugs you might expect in a newly released computer game, or a fresh off the work desk PC build project.

## Rolling with the punches

While the embedded computers in fighter jets might seem more like boys' toys for the rich or recruitable, this technology does trickle down into the reach of consumers. IEEE 1394b – better known as FireWire – is used on the F-22 to link internal components together, for instance.

The arrival of the computer in human technological evolution is arguably on a par

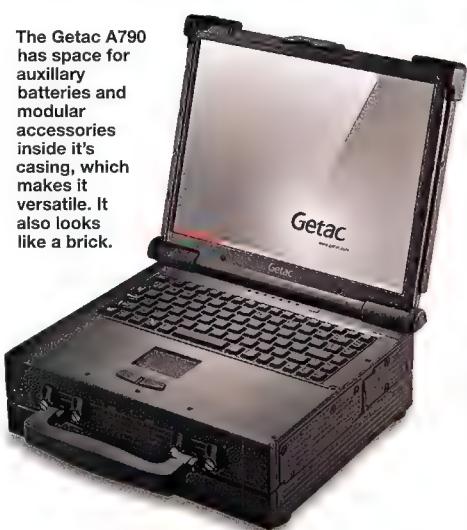




with the invention of the wheel or the pointy rock, but like the wheel and the pointy rock, its true power is only unlocked through successful implementation in the wider world. Wheels are fine, but if you haven't invented the axle or the bearing, or some way to steer, then you're going nowhere, and until you attach that pointy rock to a stick and work out the best way to chuck it, you're not going to be able to eat anything you can't catch on foot. The same is true for the computer; locked in a basement or office, the computer is a powerful tool, but when you can take computers into the outside world, their potential is greatly magnified.

As we become increasingly attached to and dependent on computers, reliability and accessibility of computer systems becomes increasingly important. As a result, ruggedisation will, in all likelihood, become a less specialised and segmented field, and seep into everyday product design. This isn't to say that all laptops will sport rubber corners and bulletproof lids, but there's a need to make them more robust, and where there's a will,

The Getac A790 has space for auxiliary batteries and modular accessories inside its casing, which makes it versatile. It also looks like a brick.



there's a way. As noted previously, low-power CPUs can function without fans, so it isn't uncommon to see netbooks without them.

What the military refers to as 'thin client' computing is being branded for consumers as 'cloud computing', and when your email, word processor and other applications are run by servers, it's possible for end users to have less complex computers, and hopefully, by extension, more reliable machines. More advanced manufacturing techniques should also lead to more reliable computers. Apple has recently moved away from plastic frames for all but its cheapest laptops, for instance, opting instead for a tougher, unibody aluminium enclosure. As smaller and more powerful chips find their way into phones, smartcards and network-aware objects, computing power becomes more widely available and resilient.

We hope for the day when our pride and joy super systems can double as hard cover. Until then, we can dream of Mil-Spec.

## Mil-Spec tech you can buy

Just 'cause it's military grade doesn't mean you can't own it. In fact, mil-spec tech is a little easier to come by than you might think – if you're willing to pay...

### Pioneer DreamBook Tough 220

**\$4,999, [www.pioneercomputers.com.au](http://www.pioneercomputers.com.au)**

We've already covered the specs of this tough little dynamo in the article proper, and really, let's be honest – it's nothing to write home about it. But in terms of ruggedness, you could probably beat a wallhacker to death with one at your next gaming LAN and still be able to fire up the Tough 220 to brag about it on Facebook.

Plus, with the added carry-handle, you get to look exceptionally tough yourself if you carry this puppy around as you're on-the-road PC.

### Ironkey Basic 1GB

**\$112, [www.ironkey.net.au](http://www.ironkey.net.au)**

USB keys are practically a dime-a-dozen these days, but the Ironkey is still a premium product. You might balk at paying over \$100 for a memory stick, but you really do get what you pay for. This stick is designed for military and high enterprise use, and features hardware level access control, always-on data encryption, a self destruct mechanism (cool, but it's just a Flash-trash mechanism, not a thermite charge or anything sexy like that) and a rugged metal casing. If you want your pr0n transported ultra securely, this is the USB stick for you.

### Blackhawk Ballistic Watch

**\$US595 <https://specialopswatch.com>**

Timepieces don't come any tougher – or cooler – than this once spec-ops-only item. The Blackhawk features a steel casing, the brightest LED light ever

installed in a watch, a ballistic Velcro band, an electromagnetically rechargeable lithium ion battery and the dial is made of carbon fibre.

Good enough for Jack Bauer, good enough for us.



### Night Vision Goggles

**Technically free...**

Probably the best example of clever product bundling we've seen would have to be the upcoming Prestige Edition of Modern Warfare 2. For, well, quite a lot of money,

you can get all the usual game collector's bells and whistles, as well as a working set of NVGs. They're head-mounted, and we can't think of any better way to see in the dark when you wake up to go to the toilet after one-too-many Redbull during your last epic fragging session.

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# HARDWARE

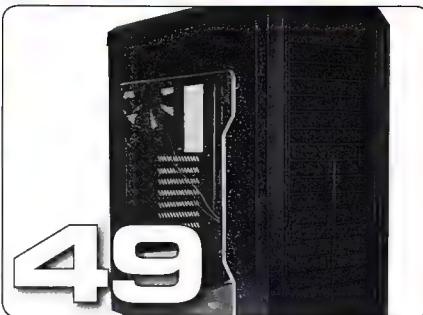
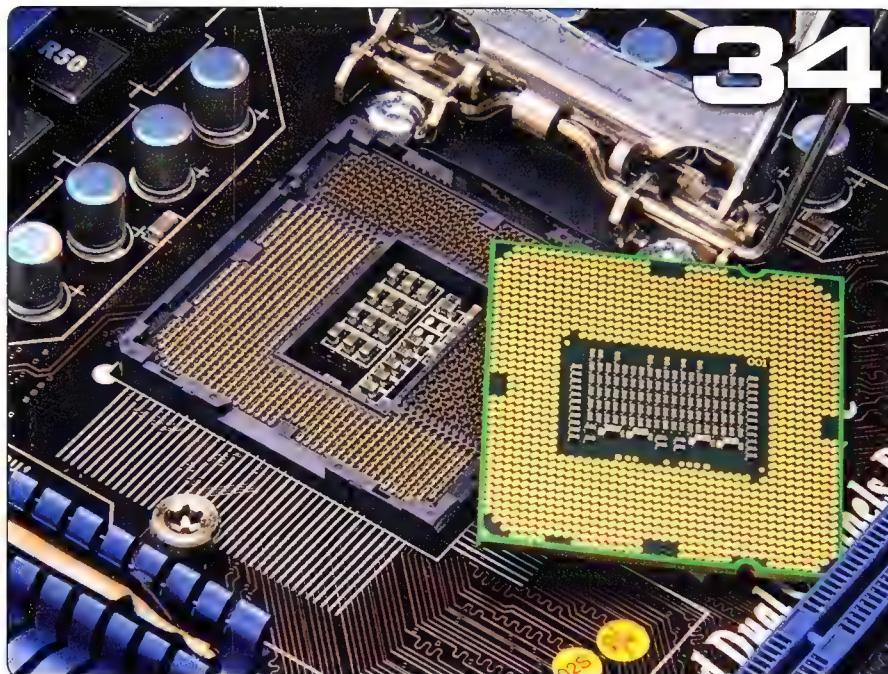
**NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE**

We're all over the latest Core i7 release this month.

Justin's been poring over whitepapers and benchmarks alike to bring you the most in-depth review of the new Core i7 870 CPU. Aka the Lynnfield, this new chip is a real eye opener – not too expensive, solid features, and very overclocking friendly.

We also take a look at three new P55 chipset boards to accompany the new processor – if you decided to skip Nehalem, this really is the upgrade you've been waiting for.

And that's just to start with! We've got new graphics cards, SSDs, gaming peripherals and a mess of new cases – and we round it all up with our biggest CPU Head2Head ever.



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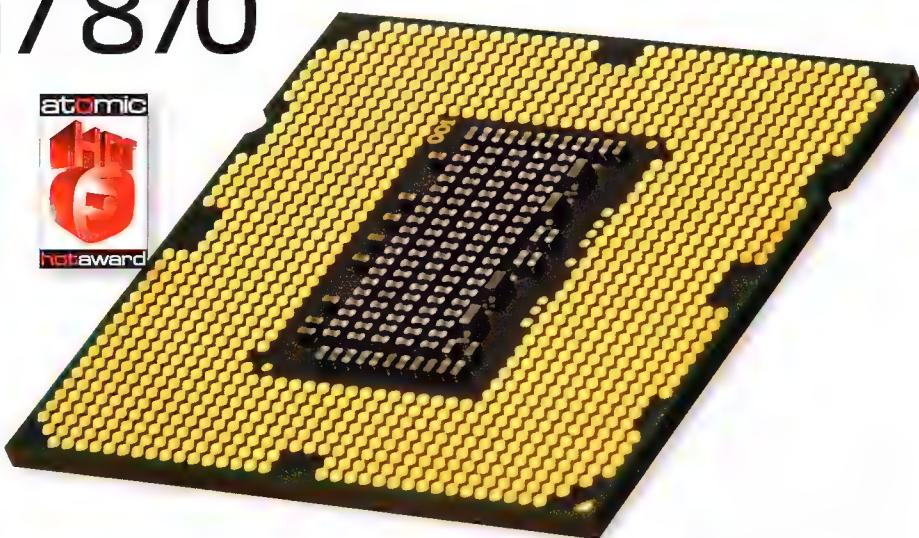
# Intel Core i7 870

Reshaping it all over again.

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Website [www.intel.com](http://www.intel.com)

Specifications 2.93GHz dual core; 45nm manufacturing process; 'Lynnfield' core; 32KB L1, 256KB L2, 8192KB L3; 22x multiplier; 95W TDP; LGA1156.



Without microprocessors in today's ultramodern world, we wouldn't be able to instantly transfer money, frag people on the other side of the planet or calculate complex equations in incredibly short periods of time. For most people a simple CPU fits this bill, but since you're reading Atomic you're anything but simple – and Intel's latest CPU is hands-down the most complex chip since last year's Nehalem. Intel's gone back to the drawing board to cram in improvements across the entire design, and once again taken the limelight with aplomb.

## Under the scope

Thanks to Intel's dogged adherence to its Tick-Tock development schedule, the latest core design is codenamed Lynnfield and slots into the Tock phase. Manufactured on a 45nm process, this is the same as the current top-end CPU, and uses the same High-K transistor material (in this case Hafnium Dioxide, HfO<sub>2</sub>) to reduce leakage and increase current – practically ensuring overclockability right off the bat. There are few changes to the way the CPU works, but these are quite minimal in the scheme of things.

Based off the Nehalem architecture that itself was based off the Core 2 design, Lynnfield features 32KB of Level-1 cache for each of the four CPU cores, the speediest memory level that feeds instructions directly into the gaping mouth of each core. Each core also has exclusive access to its own 256KB of Level-2 cache that acts as a buffer between the L1 and the final Level-3 cache, a whopping 8MB. This is mutually shared between all four cores, and they simply fight each other for as much memory as they need at the time – meaning that a single core can potentially have the whole amount. In

fact, most of the die (pictured) is devoted to nothing but cache, taking up over half of the physical area.

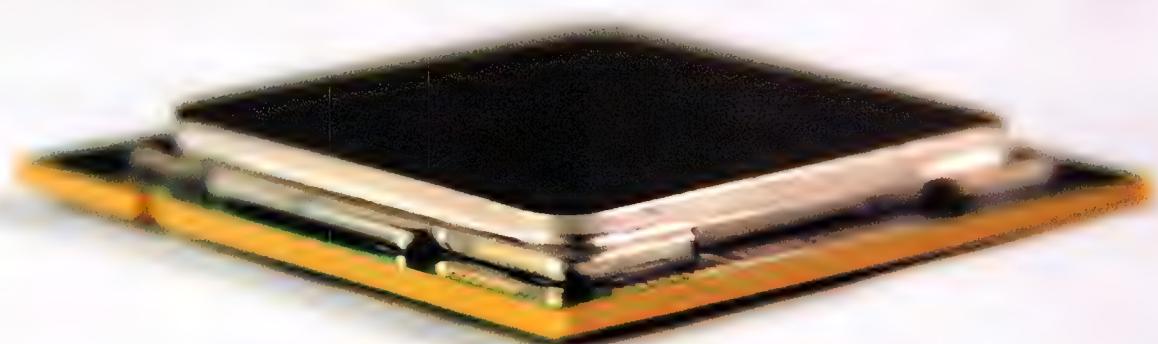
The data that is held and passed through each level of cache is finally sent through the Instruction Queue, to the Decode Stage, and is analysed by a Branch Prediction unit. This is quite literally a piece of silicon that attempts to 'guess' which instructions the code will need to use next, and fetches the relevant information to hold just in case it's needed. A Loop Stream Detector then peers into the code, detecting chunks of code that repeat themselves and keeping the instructions in L1 cache to chew through those repeated strings like a machine gun through jelly, burning through similar calculations much faster than traditional designs. Finally the analysed code is run through the Execution Units, whose task is to work on the data stored in the L1 cache and return an answer, which is sent to the L2 cache for temporary storage until it's either needed again, or moved elsewhere in the system. All this adds up to a chip that has a Thermal Design Power of 95W, which is 30W less than Nehalem and will make cooling a much simpler task.

## Memory controller

Being a direct descendant of Nehalem gives Lynnfield access to the same integrated memory controller that was traditionally packed into an external chip on the motherboard. This means that the CPU can leap directly to the DDR3 memory in the system, removing a huge chunk of latency and getting a nice speed increase at the same time. Unlike Nehalem however, Lynnfield features only dual-channel DDR support, meaning that two or four sticks of DDR3 is going to give the best arrangement for memory. Theoretically this limits the bandwidth of the memory to a comparatively sedate 17GB/s, but in practice there is little difference in memory performance between the two designs.

## Northbridge removed

One of the biggest hurdles to cost with motherboards was the requirement of two onboard chips; the Northbridge that handled the memory and expansion slots, and the Southbridge that connected up all the storage and connectivity options like USB. Something you'll note on every single motherboard for Lynnfield is the complete and total absence of a Northbridge of any kind – instead using a single



P55 Express 'Ibex Peak' chipset.

The P55 Express is essentially a glorified Southbridge chip, controlling all the SATA ports and USB ports as well as managing all those onboard chips for audio and Ethernet. A relatively small Thermal Design Power rating of 20W means that it can be easily cooled by a simple aluminium heatsink – gone are the days of elaborate heatsink and heatpipe combinations being absolutely essential (though from a marketing perspective they still make sense). Theoretically a single P55 chip will be much cheaper for the motherboard manufacturers to purchase than two chips, but the final price is up to the individual manufacturer to decide – at time of writing most prices listed are almost \$400!

Having a motherboard without a Northbridge seems to cut down on the complexity of design and helps to manage temperatures better, but without it where do all the functions it performed go? The answer, it seems, is in Lynnfield itself.

## Turbo is useless

Throughout Intel's marketing and waffle there was a lot of excitement generated about the venerable Turbo Boost; a built-in

feature that automatically steps up the CPU multiplier when under a specific TDP ceiling. In practice it seemed to be doing something, but performance results showed it did almost nothing – with Turbo on it gave a PiFast result of 29.58s at stock speeds, and with it off it gave an earth-shattering... 29.58s. This was echoed in every other test, and multithreaded *wPrime* gave 8.331 seconds with Turbo; 8.363 seconds without it. It makes for a nice selling point to less-informed consumers; but don't get drawn in by its claimed performance increases.

Hyper-Threading is something that is actually worth being excited about; a technology that convinces the operating system that there are eight CPU threads – when in reality there are only four cores. By keeping each core working on two threads at once and therefore continually busy, programs that are multithreaded gain impressive speed increases. At stock with Hyper-Threading disabled a *CineBench* multithreaded result of 14904 gives a performance increase of 3.58x; while the Hyper-Threaded result gives 16803 points for a 4.08x increase – squeezing every piece of performance out of the CPU.

## Unadulterated speed

We've covered the main points of difference with the CPU, but the time has come for performance. The specs of the rig used are no pushover:

- i7 870 2.93GHz Lynnfield CPU (8MB, 133MHz BCLK, 45nm process)
- Corsair Dominator 2x2GB (1600MHz, CL8)
- WD VelociRaptor 300GB
- GIGABYTE P55-UD6
- Thermalright MUX-120 heatsink

We'll be comparing the stock performance results against the only real competitor; Intel's own Nehalem i7 965 chip at 3.2GHz – a CPU that costs \$1600. While its Core 2 series is still decent, it doesn't touch this speed (and sadly AMD is left even further behind in the dust).

The first benchmark off the rank is *CineBench R10*, which gave Lynnfield a singlethreaded score of 4118 compared to Nehalem's 4580 (higher is better). Multithreading mixed it up a little, with a 16803 score compared to 19453 respectively. Multithreaded apps are clearly the domain of Nehalem for now, but keeping in mind that it also has a higher clockspeed these results

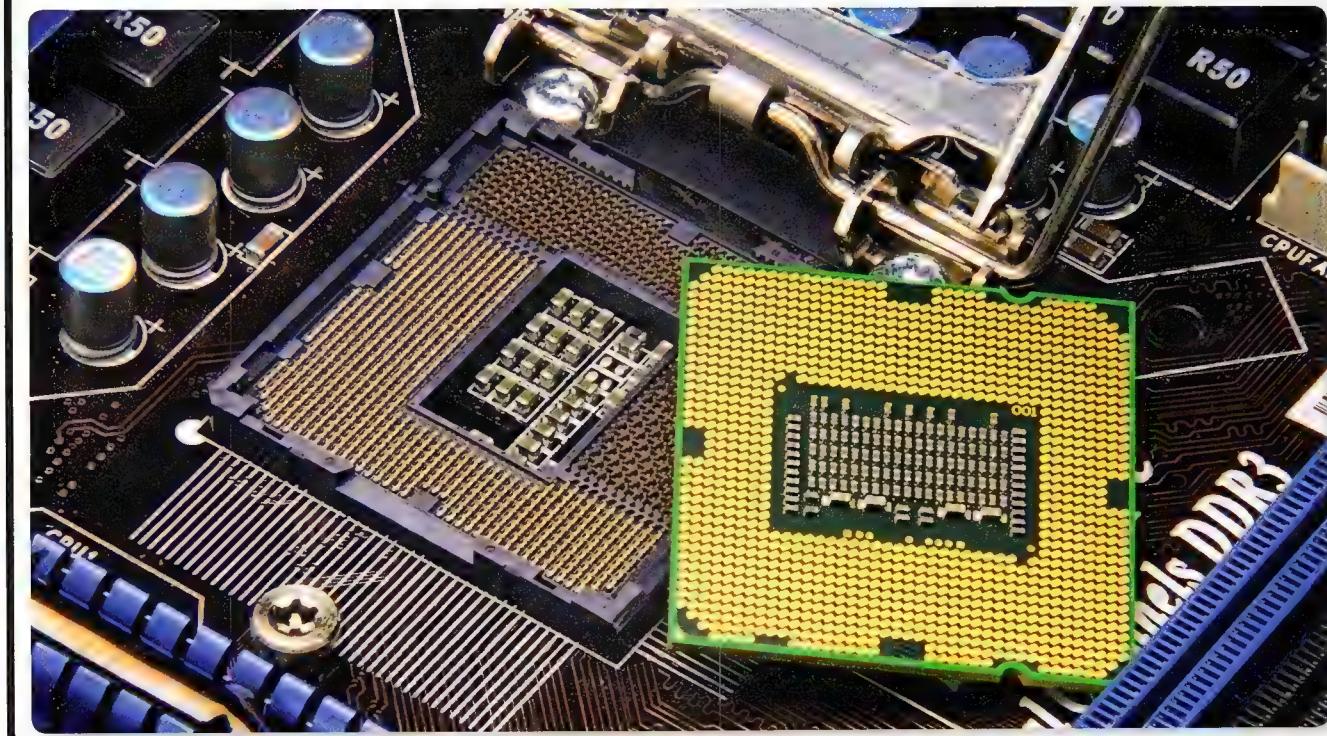
## Socket LGA1156

Lynnfield brings around not only a simple core redesign, but also a completely new socket. Called LGA1156, this is a Land Grid Array design that houses 1156 pins on the motherboard that match up to 1156 gold pads on the CPU. This design is also used on Nehalem's LGA1366, and the 210 pin difference between the two originates from the third memory channel that was not

included. Physically the pins are stronger than on LGA1136; many careless or inattentive builders managed to squish the socket accidentally, which should be less likely to happen on LGA1156.

Pulling the metal lever away from the socket and upwards causes the entire metal frame to slide backwards from the securing knob, flipping up to give access to the pins. Securing

is simply the opposite of this, and once the CPU is in it takes a similar amount of force to close as LGA1136. The underside of the socket has a metal backing plate to distribute the load of heavier heatsinks a little better, but unfortunately the stock heatsink uses the incredibly annoying pushpins. Still, it's an improvement over LGA775.



aren't anything that some overclocking can't fix.

Next up was *Hexus PiFast*, a singlethreaded application that returned a very healthy 29.58s compared to Nehalem's 26.52s (a Core 2 E8600 3.33GHz scored 28.08s in the same test). It's clear that the core frequency really helps in this benchmark, with the slowest processor returning the slowest result.

Our third benchmark was *wPrime*, which can run in both single- and multithreaded modes. Single results gave 44.054s for Lynnfield compared to 40.703 for Nehalem (lower, or faster, times are better), which again is slightly eclipsed by the E8600 at 43.325s. When we kicked it up to multithreaded mode Lynnfield closed the gap between the processors significantly, returning a 8.331s time compared to Nehalem's 7.646s.

Finally we ran both CPUs through *Everest Ultimate Edition 5.02*, the memory bandwidth benchmarks putting both designs through their paces to see if the third channel actually offers a legitimate performance increase. Surprisingly we found that it does very little; Lynnfield's dual-channel read speeds returning 14,087MB/s compared to Nehalem's triple-channel read speeds of 16,586MB/s. This is only an extra 2,499MB/s for the added expense of a third stick, which makes Nehalem's extra channel seem quite opulent. Lynnfield's latencies were actually lower too; 48.0ns compared to 55.2ns at the same memory speeds.

## Overclocker extraordinaire

No Atomican would buy a CPU and just run it at stock speeds, but as we've hinted before this CPU will make any prospective owner wet themselves in nerdish glee. Heading into the BIOS in the usual fashion, control over the CPU is very similar to Nehalem in that the Base Clock (BCLK), uncore multiplier (everything that is not cache or a core) and voltages are under total command. By increasing the BCLK speed and increasing the CPU voltage concurrently, the

### Detangling DMI

When Intel's engineers took to the Nehalem core with their teensy scalpels and instruments, they sliced away a third of the memory channels, and also added in all the features of the Northbridge that we've come to know and love. While Nehalem linked to the Northbridge via the Quick Path Interconnect (QPI), which in turn linked to the Southbridge via a DMI PCIe link, Lynnfield completely removes the first step and simply links the CPU directly to the P55 chipset through the DMI link.

What this means is that the PCIe lanes have been completely integrated into the processor itself, taking up the entire left side of the die. Due to limited space available there

speed of the CPU was also increased – and thanks to the 22x multiplier this took a lot of strain off the motherboard. Unfortunately this multi isn't unlocked, but rather ranges from 9-22x.

Rocketing to 4GHz was surprisingly easy, as the BCLK was increased to 182MHz and the core voltage upped to 1.35V from a stock of 1.2V. This is practically easy enough to do in your sleep, and even novice overclockers will be able to get this chip purring like a lion. We hit a maximum speed for this chip of 4246MHz at a BCLK of 193x22 at 1.45V, rocketing through *CineBench* with a phenomenal 24,263. A dual Xeon 5570 server scores 29,452 in the same test – this single CPU is astoundingly fast.

However, compared to Nehalem at the same clockspeed of 3.85GHz the story is even more interesting; Lynnfield scores 22.65s in *PiFast* compared to Nehalem's slower 22.96s. This is repeated in *CineBench*, hitting 5427 vs 5403, and even *wPrime* proves Lynnfield as the winner with a time of 6.364s compared to Nehalem's 6.597s. Not only does this mean that Lynnfield is in fact faster than Nehalem at the same clockspeed, but that it can do it on a cheaper platform and manage to cost half as much!

are only 16 PCIe 2.0 lanes to use, meaning that single-card systems will be fine but Crossfire or SLI will be running at 8x8 speeds – and both are supported by the CPU. Intel wasn't satisfied with only having PCIe lanes in the CPU, and in future designs are going to pack in an integrated graphics core to give some basic 2D capabilities. We won't see these until they hit 32nm CPUs, but it's just further proof that the times are a'changing.

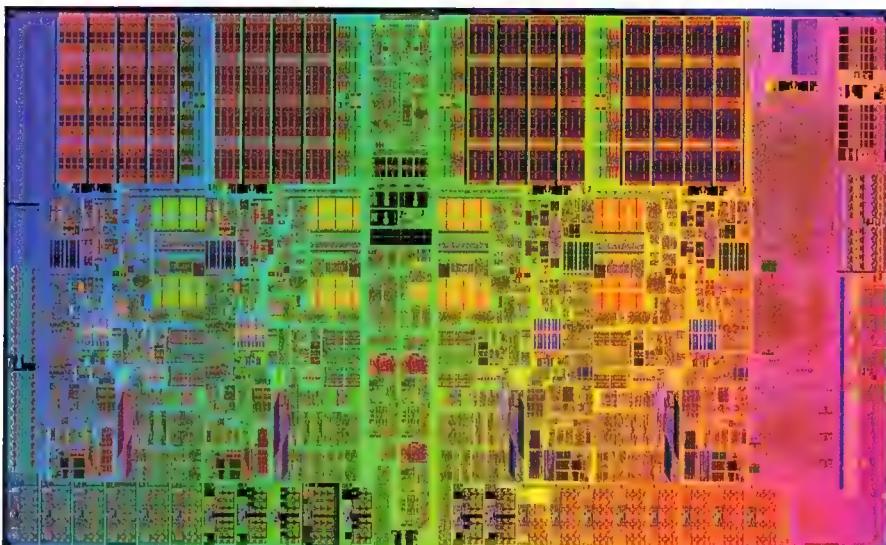
Moving PCIe into the CPU die also means that the much-touted QPI becomes outmoded, a now X58- and Nehalem-exclusive interface that offers huge bandwidth – but simply isn't needed with Lynnfield.

## Verdict: Lynnfield

When it was first announced that Intel would be making yet another socket to accommodate a mid-range chip, it was hard to feel excited about it with Nehalem already banging around enthusiast systems. What we've found in testing is nothing short of incredible – Intel has not only managed to produce a better chip than its own top-end i7 965, but its done it at half the price (even less when you consider cheaper mobos, and only two sticks of memory needed).

Perhaps most fascinating about this whole launch is that there's no longer any point buying any of the LGA1336 CPUs – period. Intel has cannibalised its own market and made the only CPU any Atomican would want; the soon-to-be announced i5 750 seems very to be very similarly amazing, so unless there's some major changes we can only recommend an i7 870 chip. By the time you've read this, the CPU will have been officially launched in stores and will most likely be even cheaper – and on the following pages we've benched three of the best P55 mobos to get the most out of the chip.

The performance crown has finally been stolen from Nehalem, and Atomic has exclusively embraced Lynnfield with wide open arms. 



# MSI P55-GD80

Close, but no cigar.

**Street Price** RRP\$389 **Supplier** MSI  
**Website** [www.msicomputer.com.au](http://www.msicomputer.com.au)

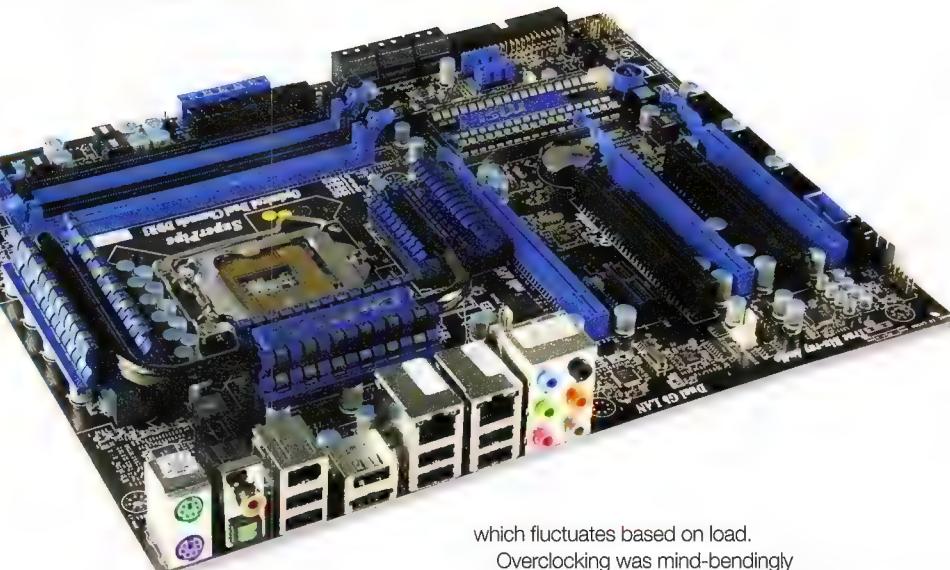
**Specifications** Socket LGA1156; Intel P55  
 chipset; ATX form factor; 3x PCIe x16; 2x PCI; 2x  
 PCIe x1; 1x EIDE; 8x SATA; DDR3-1600

**M**SI has made some stellar AMD boards over the many years the company's been in the business, but Intel boards have been something of a hit-and-miss affair that for reasons unknown still manage to plague the manufacturer. Case in point is its high-end P55 offering, which does a lot right – but also misses out on some key areas.

The P55 chip used here is the same 65nm chip as used in other boards, which manages the storage and connectivity options. This leaves PCIe duty to the CPU, and thanks to Packet Switch chips on the mobo these lanes can easily be swapped around to support multiple cards. Unfortunately there are only so many lanes; meaning that this is limited to 16x single and 8x8 dual, with the bottom slot working at 4x – even though they are physically all 16x.

Thankfully there's plenty of space around the LGA1156 socket, and a beefy 8-phase power system. The PWMs are sorted with a stylish cobalt/charcoal heatsink, hooked up with the thickest damn 8mm heatpipe we've seen used on a motherboard yet; nickel-plated to boot. In fact this board is arguably the most physically attractive we've ever seen; and the dark brown PCB only adds to this effect. In a move that continues to confound us, the traditional Northbridge area has nothing but Packet Switch chips – simply with a foam pad on top and then heatsink above. The actual P55 chipset sits where the Southbridge is, and is effectively separately cooled by a small heatsink.

Four DDR3 slots are the order of the day, with the 24- and 8-pin CPU power sockets being placed in very nice locations. Next to the former



is a bank of six power measurement points that give direct voltage readings – handy for overclockers. Four hard switches near this allow extreme overvoltage of components. Also handy are the five fan headers dotted across the mobo.

Six right-angled SATA ports and a right-angled IDE port lie across the edge of the mobo, with a further two vertical SATA ports just behind them. Two BCLK control buttons allow manipulation of clockspeed in realtime, while the LED POST screen continually displays the current CPU temp. An OC Genie and Clear CMOS button lie beside the screen. MSI has gone all-out with the power, reset and 'Green Power' buttons – they're moved to an electro-statically sensitive panel at the bottom and are activated smoothly; they feel great to use. Plenty of USB headers and a single Firewire fill out the complement at the bottom, as well as an audio header.

Rear I/O options cover an odd two PS/2 ports, seven USB, 6-pin Firewire, two Ethernet and 7.1 channel audio (off a Realtek ALC889). There's also another LED screen behind this area that displays the current power phase of the CPU,

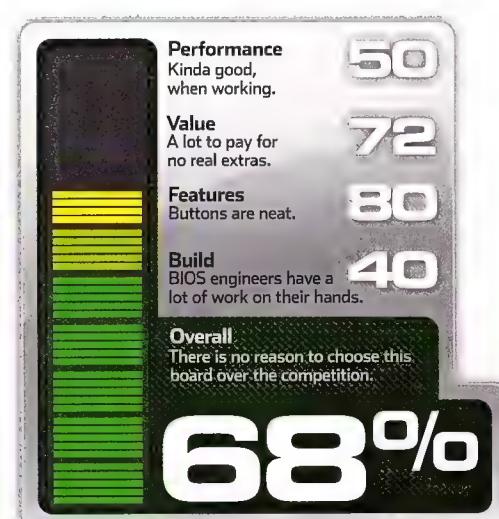
which fluctuates based on load.

Overclocking was mind-bendingly astronomically frustrating with this motherboard. If my notepad, coated with lovely things like "Random Crashes..." and "NO OC AT 22x D:" manages to give anything away, I did not have a good experience here at all. Stock performance was higher than GIGABYTE in most benchmarks, and significantly higher at the first OC step, but even that had to be run at 165x20 rather than 150x22. The highest manual overclock that actually worked (minus the constant random hangs and crashes) was a poor 180x20, only 3.6GHz – laughably poor when this chip tops out at 4.2GHz, especially considering the not-insignificant effort involved. Even more annoying was the fact that the OC Genie auto-overclocking button could get higher than my overclock – fucking ridiculous, and an obvious sign that MSI's BIOS simply isn't ready.

MSI might fix the BIOS sometime down the track, but until they do I suggest you avoid this board like the plague. 

## MSI P55-GD80

	7870	133x22; DDR3-1600 8-8-8-24	165x20; DDR3-1656 8-8-24	197x19; DDR3-1180 9-9-9-24 OC Genie
PiFast	27.21s	22.01s	23.71	
wPrime 32M – single thread	46.435s	32.729s	34.788s	
wPrime 32M – multi-thread	8.315s (5.59x efficiency)	7.379s (4.44x)	6.568s (5.30x)	
CineBench R10 64-bit – single thread	4493	5584	5263	
CineBench R10 64-bit – multi-thread	16928 (3.77x efficiency)	19123 (3.42x)	21319 (4.05x)	
Everest Read	14344MB/s	14818MB/s	14654MB/s	
Everest Write	10856MB/s	13449MB/s	15433MB/s	
Everest Latency	46.8ns	46.1ns	48.7ns	



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[www.msicomputer.com.au](http://www.msicomputer.com.au)

# GIGABYTE P55-UD6

Best overclocker of the bunch.

**Street Price** \$375 **Supplier** GIGABYTE  
**Website** [www.giga-byte.com](http://www.giga-byte.com)

**Specifications** Socket LGA1156; Intel P55 chipset; ATX form factor; 3x PCIe x16; 2x PCI; 2x PCIe x1; 1x EIDE; 10x SATA; DDR3-1600

**Gallery** [www.atomicmpc.com.au/?151897](http://www.atomicmpc.com.au/?151897)

**F**irst out of the gates with a P55-based motherboard is the big blue giant GIGABYTE, slotting first in line to get tested with the i7 870 chip. We've held GIGABYTE in good stead many times before, so we've got high expectations for this board – and we weren't disappointed.

As mentioned, this motherboard is running Intel's latest P55 Express chipset, a chip which is manufactured on a 65nm process and contains all the storage options available on the motherboard. It also links with the components onboard to give audio and networking capabilities, and is the sole chipset. Slotting inbetween the CPU and PCIe slots are four thin chips just below the first PCIe x16 slot, called Packet Switch chips, and these allow the PCIe lanes to be rerouted to the remaining slots in the presence of multiple graphics cards. Unfortunately for those planning on running multiple cards, two cards will run in 8x8 PCIe 2.0 mode – and the bottom slot will only run at 4x speed. Still, they're equally as compatible with other PCIe devices, and a single graphics card isn't too restrictive.

The area around the LGA1156 socket is the most packed we've ever personally seen, with a

## Smart Six

GIGABYTE has toolled with the 16MB BIOS chips on this mobo, and include six programs to speed up boot time, auto-overclock the CPU, recover the system to a previous state, store passwords, monitor file changes and even a Bluetooth-powered harddrive encryption system – nice one!

## GIGABYTE P55-UD6

	17870	133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
PiFast	29.58s	24.20s	22.65s	
wPrime 32M – single thread	44.054s	35.864s	33.556s	
wPrime 32M – multi-thread	8.331s (5.29x efficiency)	6.863s (5.23x)	6.364s (5.27x)	
CineBench R10 64-bit – single thread	4118	5058	5427	
CineBench R10 64-bit – multi-thread	16803 (4.08x efficiency)	20641 (4.08x)	21780 (4.01x)	
Everest Read	14087MB/s	14906MB/s	15854MB/s	
Everest Write	10752MB/s	12177MB/s	14101MB/s	
Everest Latency	48.0ns	45.6ns	44.7ns	



whopping 24 phases of power available for the CPU. Each of the PWMs around this are treated to their own heatsink, incredibly styled in a race-car theme that looks very sexy (though perhaps a darker PCB colour would make it even more attractive). There's plenty of room around this socket for heatsinks, but the first DDR3 slot will be blocked due to close proximity. Six slots are used, though due to the dual-channel limitation this only allows more memory to be used – not a performance increase. A power button sits at the top-right – incredibly handy for overclocking – and is out of the way of graphics cards.

Ten right-angled SATA ports line up along the right-hand side of the mobo, and while they're not the SATA 3.0 ports we'd heard musings about they are RAID capable. An IDE port is included for those who stick to their old-school tech, and even a floppy port makes an appearance at the bottom of the board. An LED POST screen is in the corner next to the front panel headers, but doesn't show anything once

booted into the OS. One small CMOS button is also in this corner. USB and Firewire headers lie along the bottom edge, but the audio is tucked near the I/O ports in typical GIGABYTE fashion.

I/O options are great, with one PS/2, eight USB, Optical/Coaxial, 6-pin Firewire, 4-pin Firewire, two Ethernet and 7.1 channel audio (off a Realtek ALC889A). The cooling array is a little silly however; while the P55 chip in the middle could be cooled by that heatsink alone, there is no Southbridge at all – rather just an aluminium cap that sits there and looks pretty. This was evidenced by the very cool running temp, needing very little airflow.

Overclocking performance was the best we've seen yet, rocketing all the way to 193x22 for a final speed of 4246MHz. The BIOS was incredibly clear, and the board felt more solid than three-foot lead plating. While performance wasn't as good as ASUS' board, this one is the board of choice for overclocking champions. 



# ASUS M4A785TD-V EVO

An improvement in almost every way.

**Street Price** \$155 **Supplier** ASUS  
**Website** [www.asus.com](http://www.asus.com)

**Specifications** Socket AM3; AMD 785G chipset; ATX form factor; 2x PCIe x16; 3x PCI; 1x PCIe x1; 1x IDE; 5x SATA; DDR3-1333

**A**MD caters for different users with a few distinct chipsets, targeting the 790FX at cashed-up enthusiasts, the 790GX at those who want good performance with not quite so much money, and the 780G for those who just want something that'll work well. The M4A785TD-V EVO manages to disguise it annoyingly effectively, but the chipset that is running in here is AMD's latest – the 785G. Slotted in just between the 780G and 790GX, the 785G is set to be an incremental update to the chipsets, but in testing proves to be so much more.

Manufactured on AMD's now reliable 55nm manufacturing process, the 785G chipset comes with a built-in graphics core that is comparable to a HD4200 graphics card. This means that the core only has 40 shader units (compared to the 4870's 800) at a core clock of 500MHz, but this was still enough to give a 3DMark06 result of 1619. Not enough to rock the world too much, but plenty of speed to play older games without a hitch. Perhaps better than this is built-in hardware support for video playback, hardware acceleration of decoding and interestingly it even includes DVD upscaling support (great for giving some life to your old discs on high-resolution screens).

Also part of the chipset is a small amount of DDR3 memory soldered onto the motherboard, which acts as a framebuffer, minimising the impact on the system memory. It can even be overclocked through the BIOS, with control over the core and memory speeds for those who want every piece of performance. Amazingly the heatsink that cooled the chipset remained cool to the touch even when running 3DMark06, and



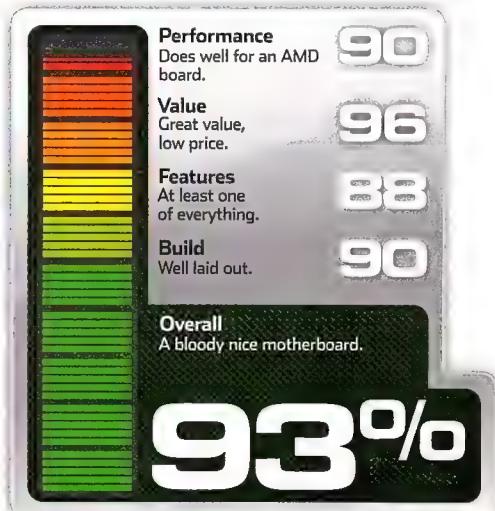
even without airflow managed to handle the heat admirably.

The rest of the motherboard is quite good as well, with plenty of room around the CPU socket to install heatsinks (though the first two DIMM slots were blocked when our Thermalright Ultra 120 eXtreme heatsink was installed), and the power regulation's heatsink performed almost as well as the Northbridge's. DDR3 is the order of the day here, and support for socket AM3 CPUs only. A 4-pin CPU power coupling is in a decent spot, while the 24-pin power is along the edge of the mobo. Five vertical SATA ports lie just out of the way of the first PCIe 16x slot, so long graphics cards shouldn't interfere with storage.

An IDE socket lies again just before the second PCIe 16x slot, so those with the ageing tech can still use their older drives. Front-panel connectors are in the usual corner at the bottom, with USB and audio headers along the bottom

edge of the board. Plenty of expansion slots fill out both PCI and PCIe needs, though the grey PCIe slot runs at 4x with a card in the primary slot. The I/O panel covers PS/2, six USB, Optical, HDMI, DVI, VGA, 6-pin Firewire, hybrid USB/eSATA, Ethernet and 7.1 channel audio. HDCP is definitely confirmed, which will be nice for the HTPC crowd.

Overclocking performance was actually not too shabby, with a maximum stable bus speed of 241MHz just a few points shy off what the chip can do. The BIOS is well-laid out, and though it was a bit tricky to find where they'd put the overclocking options (hidden in something called "Jumperless Configuration", or along those lines) they worked just fine in use. The best thing about this motherboard, save for the nice chipset, good overclocking and good features is the price tag – rocking in at a phenomenally affordable \$155 you'd be stupid not to nab it.  JR



## ASUS M4A785TD-V EVO

	X4 955	200x13; DDR3-1333 7-7-7-21	217x13; DDR3-1446 7-7-7-21	230x13; DDR3-1532 7-7-7-21
<b>PiFast</b>	33.85s	31.15s	29.52s	
<b>wPrime 32M – single thread</b>	44.525s	41.031s	38.844s	
<b>wPrime 32M – multi-thread</b>	11.635s (3.82x efficiency)	10.781s (3.81x)	10.296s (3.77x)	
<b>CineBench R10 64-bit – single thread</b>	3717	3997	4200	
<b>CineBench R10 64-bit – multi-thread</b>	13200 (3.55x efficiency)	14916 (3.73x)	15046 (3.58x)	
<b>Everest Read</b>	8400MB/s	9107MB/s	9595MB/s	
<b>Everest Write</b>	6603MB/s	7190MB/s	7591MB/s	
<b>Everest Latency</b>	50.8ns	47.3ns	45.6ns	

# ASUS P7P55D Deluxe

The tech equivalent of caviar.



**Street Price** \$411 **Supplier** ASUS

**Website** [www.asus.com.au](http://www.asus.com.au)

**Specifications** Socket LGA1156; Intel P55 chipset; ATX form factor; 3x PCIe x16; 2x PCI; 2x PCIe x1; 1x EIDE; 9x SATA; DDR3-1600

**Gallery** [www.atomicmpc.com.au/?149836](http://www.atomicmpc.com.au/?149836)

**S**ome crazier people liken motherboards to things such as cars or planes, but this one actually lives up to its pedigree – this is definitely your Lamborghini Diablo-equivalent mobo. From the exquisite contemporary heatsink design on the PWM, the softly mood-lit heatsink on the P55 chipset and the dark PCB, this truly is one board that was built from the ground-up for raw, groaning sex appeal – even the solid capacitors are all coloured to fit in with the colour scheme!

The LGA1156 socket has the most clearance around it yet, but still manages to pack in sixteen phases of power straight to the CPU. There are no awkward heatpipes to spread the heat around; rather two thin aluminium strips are applied to the underside of the PWM areas to radiate from *both* sides of the board. Four DDR3 slots are arranged in the usual place, but these latch on the top side only, making changing out memory sticks a breeze. We had odd compatibility issues with a set of Corsair Dominator 1600 CL8, but this is fair enough considering the early BIOS, and our only annoyance.

The mobo power sockets are in great places, and a simple MemOK! button sits to the right of the DDR3 slots. This is kinda pointless, but just like an oak-panelled dashboard it's nice to have. A right-angled IDE port sits just before six right-angled SATA ports, joined at the bottom of the board by a further three vertical SATA ports. Hard power and reset buttons lie along the bottom of the board, along with USB, audio and Firewire headers.

Expansion slots are pretty good, with 16x bandwidth for single cards, 8x8 for dual cards and a bottom slot working at 4x – even though



they are all physically 16x. The Packet Switch chips lie uncovered underneath the top PCIe slot, and there is no silly heatpipe across the board. Four fan headers are spread across the board, though the heatsinks barely got noticeably warm under load.

Rear I/O options are quite good, with a strange two PS/2, Clear CMOS, eight USB, Optical/Coaxial, two Ethernet, 6-pin Firewire and 7.1 channel audio (off a VIA VT2020). This audio chip is technically better than the Realtek ALC889 chip, so will prove to be more pleasing to the ears in the long run. Something quite strange was a header called 'TURBO\_CON' that sat behind these ports, but nothing was included to use it (presumably some additional screen or such can be bought later on). Also noticeable was the absence of any LED POST screens, though the missing floppy port was actually appreciated.

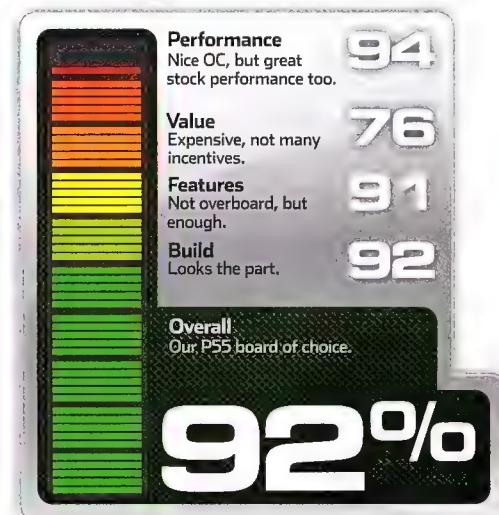
The BIOS was clearly laid out in typical ASUS fashion, each option being easy to access and

even easier to change, while most options had descriptions and warnings when increased too high. Overclocking was a little different with this mobo compared to GIGABYTE, hitting a max speed of 22x175 – but when the multi was dropped to 20 it reached a speed of 205MHz, giving an effective final speed of 4.1GHz. It isn't as high as the competition, but is still a decent result.

Where this board really shows its stuff is performance – at stock the ASUS shaved more than two seconds off GIGABYTE's PiFast score, something that repeated throughout all the other stock benchmarks. The first OC step was where its opponents caught up, results almost identical to each other, but ASUS pulled into a clear lead by the second OC step – meaning that it has got a better-tuned BIOS for sheer speed. If we had to choose between a slightly higher overclock and significantly better performance – we'll pick the latter every time.

## ASUS P7P55D Deluxe

	17870 8-8-8-24	133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
<b>PiFast</b>	27.32s	24.23s	20.97s	
<b>wPrime 32M – single thread</b>	40.232s	35.755s	30.623s	
<b>wPrime 32M – multi-thread</b>	7.628s (5.29x efficiency)	6.755s (5.23x)	5.818s (5.27x)	
<b>CineBench R10 64-bit – single thread</b>	4477	5073	5932	
<b>CineBench R10 64-bit – multi-thread</b>	18095 (4.04x efficiency)	20548 (4.08x)	23902 (4.03x)	
<b>Everest Read</b>	14323MB/s	14947MB/s	16130MB/s	
<b>Everest Write</b>	10874MB/s	12221MB/s	14269MB/s	
<b>Everest Latency</b>	47.3ns	45.5ns	43.9ns	



# Sapphire 4770

40nm of fun.

**Street Price** \$160 **Supplier** Sapphire  
**Website** [www.sapphiretech.com](http://www.sapphiretech.com)

**Specifications** 750MHz core; 799MHz memory (3196 effective); RV740 core; 640 shader units; 512MB GDDR3; 128-bit memory interface; dual slot PCB with active cooling; 6-pin PCIe power connector

**Card info** [www.techpowerup.com/gpu/7sxwe](http://www.techpowerup.com/gpu/7sxwe)

**S**apphire is one of the more well-known partisans on team red, pumping out plenty of ATI-based cards to sate even the most rabid fanboi-lusts and doing so at a price that is inoffensively attractive. This one is no different, bumping in at a decent cost of roughly \$160, though the adage "you get what you pay for" is very much in play here – there ain't much to this one to set it apart from the rest out there. Still, there is a card here to look at, so let's dive deep into the meat and potatoes.

Nestled deep within the somewhat miniature core are 640 shader units that each collectively form a community of 'brains', making up one super-brain that can power through massively parallel workloads faster than a hot knife through butter. They run at a reference speed of 750MHz and work alongside 512MB of GDDR3 memory that gives plenty of memory bandwidth to keep the graphics 'brain' well-fed with delicious data. The RV740 core contains all these shader units, and is manufactured on the slimming 40nm manufacturing process – amusingly enough actually smaller than the current best that CPUs can manage (though this will invariably change in coming years).

Not surprising is the compatibility with PCIe 2.0, offering twice the bandwidth of PCIe 1.0. While this is set to be superseded eventually by the cleverly-named PCIe 3.0, current cards can't even make use of the bandwidth afforded by



2.0, so the change is going to be a while off yet.

Physically the card is quite striking, taking up two expansion slots when installed in a computer and guzzling down one PCIe 6-pin connector's worth of juice. The power regulation at the far end of the card is pretty standard, save for the single aluminium heatsink with the Sapphire logo on it. A series of eight GDDR3 chips fill out the memory complement, though these are not cooled by any heatsinks. Thankfully they are Qimonda chips, which have proven decent overclockers even at a higher heat load. The usual swathe of solid capacitors and teeny resistors fill out most of the PCB, working to power the two DVI ports and a single analogue video out. Two Crossfire nipples rest at the top edge of the PCB, letting any two or more ATI cards from the 4xxx series to hook up with each other and make glorious pixels appear faster on your screen.

Cooling duties are performed by the single

copper heatsink that, coupled with the centrally-mounted fan, keep idle temps at a nice 47 degrees with only 51dBA. This rises quite a bit to 67 degrees and 55.5dBA load, but overall this isn't an absolutely terrible result considering the price. When pushed this card managed to hit a core speed increase of twenty per cent (901MHz), and a memory speed increase of seventeen per cent (933MHz). This isn't as impressive as XFX's 4770, which hit twenty five per cent, but it's still a nice amount of extra (and most importantly free) speed.

Performance in game benchmarks is pretty good, though you'll be wanting something a little beefier than this to run Crysis at a fast clip. GRID is fast and smooth, while both 3DMark programs come in with nice enough scores. This isn't the best performance we've ever seen, but for the price it's certainly nothing to complain about (especially considering how much you'd have to pay to get this two years ago!).

Bundle is nonexistent save for cables and driver CD, but availability might still be a pain thanks to limited shipments of the cores. 



## Sapphire 4770 3d Mark scores

3DMark 06 - 12995

3DMark Vantage - P7987

Score

## Sapphire 4770 Gaming Benchmarks

Average - 41.28

Minimum - 30.28

Maximum - 46.17

Average - 65.79

Minimum - 49.00

Maximum - 76.00

# Amaze 4870

Brand-new brand, same old hand.

Street Price \$220 Supplier Altech

Website [www.altech.com.au](http://www.altech.com.au)

**Specifications** 750MHz core; 900MHz memory (3600 effective); RV770 core; 800 shader units; 1GB GDDR5; 256-bit memory interface; triple slot PCB with active cooling; dual 6-pin PCIe power connector

Card info [www.techpowerup.com/gpuz/geg9u](http://www.techpowerup.com/gpuz/geg9u)

With a name like Amaze you'd half expect us to use all kinds of delightfully amusing puns, but if we did that there'd be almost no room for the actual review (so we'd better just get on with it). Amaze is a new brand in Australia, working with AMD/ATI to bring us decidedly red cards at a price that isn't lip-quiveringly huge. Can it bring something new to the scene, or is this just another fish in the sea?

Based on the incredibly popular RV770 core that saw first use in the 4870 launch over a year ago, it's a 55nm chip that packs in 800 shader units – the highest amount for an ATI core. Running alongside the core is 1GB of GDDR5 memory on a 256-bit memory bus, giving a decadent amount of bandwidth; more than enough for every memory-intensive graphics app out there (which admittedly isn't much). Each component here runs at stock speeds, with the core at 750MHz and the memory quad-pumped

## Catalyst Calamity

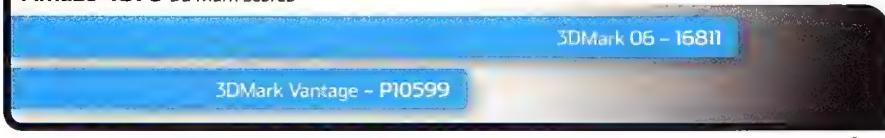
Catalyst drivers receive quite regular monthly updates and have always been a little oddly laid out, but the most recent 9.7 driver has completely redesigned the Control Centre and made it a pain to use. We suggest checking out ATI Tray Tools, to save navigating the hideous redesign ([www.guru3d.com/article/ati-tray-tools-/](http://www.guru3d.com/article/ati-tray-tools-/)).

from 900MHz to an effective 3600MHz. The RV770 core devours 160W of power as its maximum Thermal Design Power rating, but when overclocked this can be raised even higher, requiring two 6-pin PCIe power connectors as well as the PCIe bus to provide enough power.

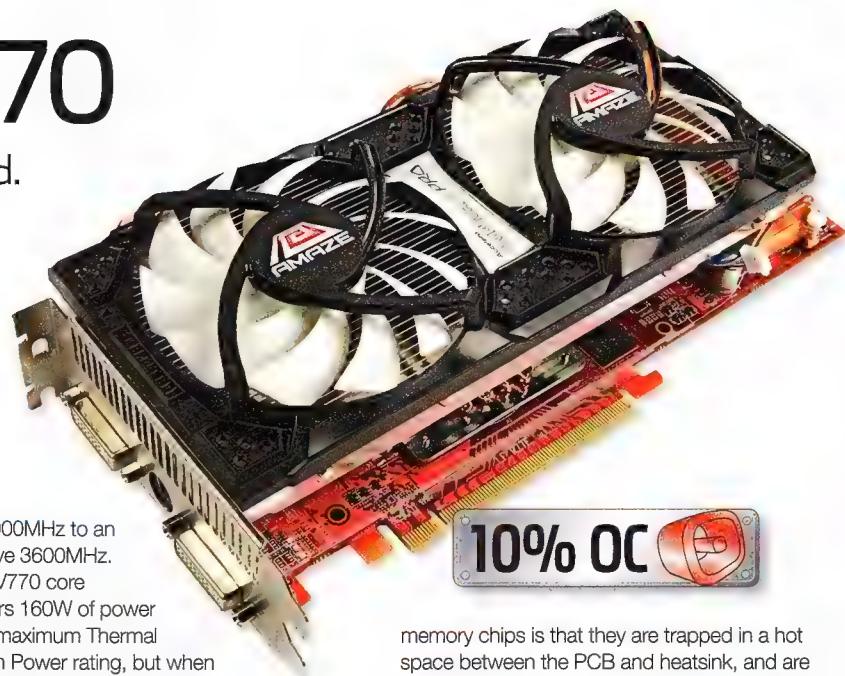
Due to all this heat, Amaze has thrown on an Arctic Cooling Accelero Twinturbo PRO heatsink. While it's more than a bloody mouthful to say, the cooler keeps temperatures in check at 39 degrees idle with 54.4dBA – rising to only six degrees higher at 45 degrees load with 55.2dBA. This isn't the quietest heatsink out there, but there's so much thermal headroom here that we managed to eke out an extra ten per cent on the core clock (844MHz). Unfortunately the memory refused to overclock at all; hitting only an extra one per cent (912MHz), most likely due to the lack of any heatsink or airflow.

The design of the cooler is to blame here. With a solid copper base and four 6mm heatpipes rising into a series of long aluminium fins, it manages to block almost all the airflow actually reaching the PCB. What this means for the

## Amaze 4870 3d Mark scores



## Amaze 4870 Gaming Benchmarks



10% OC

memory chips is that they are trapped in a hot space between the PCB and heatsink, and are running pretty close to the edge of their thermal limits. One very odd design choice was the strip of copper that runs along the top length of the card; presumably to hold the card straight with the heavy-ish three-slot heatsink, but it doesn't cool any components at all.

It's disappointing to see that this model of the Amaze 4870 costs \$40 more than the reference cooler, but doesn't include even a small overclock from factory. Nor does the bundle offer anything in the way of extra value, with only cables and a driver disc. In the end though it all comes down to performance, which is something that this card does quite well.

Crysis was inherently playable on this card, and GRID never dropped below a silky smooth 80fps, meaning that pretty much any game will run well. Benchmark results were quite nice too, and while it's not quite as fast as the 4890 or GTX285, it still has enough power where it counts. For a cool card that isn't too expensive, the Amaze 4870 is worth pondering. 

**Performance**  
Nice speed,  
overclocking hindered.

**82**

**Bundle**  
Nothing but cables.

**70**

**Value**  
Nice cooler, little else.

**79**

**Build**  
Amazing temps.

**93**

**Overall**  
A decent showing from  
newcomer Amaze.

**84%**



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# ASUS EAH 4890

An imposing card keen to overclock.

**Street Price** \$339 **Supplier** Asus  
**Website** [www.asus.com.au](http://www.asus.com.au)

**Specifications** 850Mhz core; 975Mhz memory (3900 quad pumped); RV790 core; 800 stream processing units; 1Gb GDDR5; 256-bit memory interface; dual slot PCB with active cooling; 2x 6-pin PCIe power connector.

The ASUS 4890 is an impressive heavyweight in the field of single GPU cards at 806g, adorned with a solid heatsink and bright war paint. Three pipes draw heat from the GPU and deposit it around the fan which cleverly exhausts out the back of the case in this monster 2 slot card. You had better check your power supply is up to the task as ASUS recommend 500W plus for the 4890 which consumes 190W full load via two by six pin PCEe connectors.

Removing the heatsink assembly reveals two rows of Qimonda memory chips, the standard ASUS red PCB and quality solid caps and components. The Qimonda chips are renowned overclockers and the whole build quality is impressive.

The stock card runs at 850Mhz core and 975Mhz memory quad pumped, due to the GDDR5, to 3900Mhz. The memory interface is a wide 256bits providing 124.8GBs of bandwidth. Maximum DVI resolution is 2560x1600 with anti aliasing up to 24x. The 4890 is DirectX 10.1 compliant with Havoc capable physics.

Testing was somewhat interesting on a very non Atomic standard P35-DS3R with a Q6600 quad core and 4Gb RAM system which is usually a business machine. After quickly testing the ASUS EAH3850 TOP already in-situ it was the turn of the 4890 to shine.

I quickly found out why reviewers don't use a Flatout2 benchmark as FRAPS revealed it was locked to a maximum of 60fps. Interestingly



Flatout2Mark did show an increase from a minimum of 18fps with the 3850 to 59fps with the 4890...whooh!

Obviously I needed a serious benchmark so a download of Crysis Demo and Crysis Benchmark later resulted in much better figures. At stock speeds the 4890 ran Crysis at an almost playable 22.1fps average and scored P9365 in 3DMark Vantage at 1680x1050 with 16xQ AA and very high settings.

For the first time ASUS has provided GPU voltage tweaking on the 4890, which should result in higher, stable overclocks. Using ASUS SmartDoctor both clocks could be maxed out on the sliders giving a core clock of 1000Mhz (a 17.7 per cent increase) and memory clock of 4800Mhz quad pumped (a 23.1 per cent increase) with Vcore tweaked to 1.385V. An impressive 153.6GBs of memory bandwidth resulting in

a 26.7fps average in Crysis and a P10367 in 3DMark Vantage. Considering the clock settings max out well before vCore reaches 1.45V the card may be capable of even higher overclocks.

The fan is generally quiet and keeps the core temperature around 52 degrees idle increasing to 54 degrees running Crysis at stock and 62 degrees with both clocks maxed out. You won't want the fan running at full speed as taking manual control and dialling up 100 per cent had me looking out the window for the light aircraft about to crash into the building. This sucker is loud!

The 4890 is an imposing card but I can't help thinking it may be trumped in the near future as competition heats up in the mid range arena. The 4890 is a pack leader but with the shift to the 40nm process happening right now we can expect a range of less power hungry, cheaper and cooler cards with similar figures soon.

David Gill

## Asus EAH4890 3d Mark scores



## Asus EAH4890 Gaming Benchmarks



**Performance**  
Great at stock, easily overclockable.

**Bundle**  
Leather mouse mat, drivers, cables, adapters but no game.

**Value**  
Good bang for buck.

**Build**  
A1 quality components.

**Overall**  
Top of the heap but a new heap is coming.

**85%**

# Intel X25-M 160GB SSD

The first 34nm flash chips are here!

**Street Price** \$700 **Supplier** Intel

**Website** [www.intel.com](http://www.intel.com)

**Specifications** 160GB (149 formatted); 64MB cache; 2.5" form factor; SATA2.0 3Gb/s

**S**SDs are big news right now, and with Intel's promise to bring affordable SSD storage to computer stores worldwide has offered up this first test of its latest X25-M, weighing in at a largeish 160GB size. Unfortunately it doesn't appear quite as cheap as Intel might have let us hope, but at \$700 it's not an inconceivably huge price – considering the performance.

Fitting into the small silver casing that from this launch will be the colour of choice for Intel, physically it's the same 2.5in laptop form factor as most other SSDs. Case manufacturers are just now incorporating a 2.5in mount into their designs, so if you're lucky enough to be building a new system keep your eyes peeled for a case with a spot for one of these!

The 34nm flash chips used here give a great performance result, with a large 244.9MB/s burst speed, 0.1ms access time and an average read of 220.5MB/s. That alone is good; but this drive had the smoothest sustained speed we've seen yet, managing to hit that

speed reliably and consistently.

Write speeds were also quite nice, and copying files, such as the Crysis install folder, was completed noticeably quicker than other drives.

Intel's first SSDs suffered from incredibly reduced performance when the storage of the drive was reduced to five per cent or less free space (which they later fixed with a firmware update), but this drive isn't affected anywhere near as much. Burst speeds remained the same when full, but average read dropped to 192.9MB/s and was quite erratic, at times very fast and others quite slow.

Still, if you want an incredibly fast SSD and don't think you'll be filling up the whole 160GB, this is a very nice choice – at any rate, the jealousy of those around you totally makes it worth it. 



**Overall**  
Fast, but expensive.

**76%**

# Corsair P128 SSD

More tiny flash chips!

**Street Price** \$485 **Supplier** Corsair

**Website** [www.corsair.com](http://www.corsair.com)

**Specifications** 128GB (119 formatted); 128MB cache; 2.5" form factor; SATA2.0 3Gb/s

If the above SSD is very exciting, this Corsair is decidedly less so. Not to say there's nothing interesting about it at all – rather that it is simply a standard design that uses the current enthusiast choice in memory chips – Samsung. The company's consistently produced some very reliable flash memory, so pairing them up with a Samsung controller (as opposed to the Indilinx that it competes directly against) makes sense.

Storage space is quite limited in this drive, with only 119GB available after formatting as NTFS, though a huge read/write cache of 128MB makes a show here as twice the space that is usually included. Also amusingly (and due to the inherent lack of movement in solid state) this drive can take up to 1500G shock – perfect for any Mil-Spec use.

Unfortunately this expanded cache made

little impact in actual read performance, giving a burst speed of 236.5MB/s, an access of 0.1ms and an average read of 201.9MB/s. This is quite good, but can't touch the X25-M for speed. Write speeds were huge in comparison however, consistently hitting well over 100MB/s when copying files and taking a significantly smaller amount of time to fill to capacity.

When full to bursting we found the same story as every other SSD, with burst remaining the same but average read speeds falling to 177.5MB/s, a loss of 24.4MB/s. This is slightly less speed than the X25-M dropped, but is still quite low. Made even worse by the small amount of space when formatted is that this will drive can fill up surprisingly fast, so make sure you have a traditional HDD for storage and pagefile use.

It's an interesting foray into storage for Corsair, and it's quite affordable for what it is, so we'd recommend you consider one of these for your first step into solid state. 



**Overall**  
Small size, but good value.

**84%**

# CS-M Weapon of Choice M4 DM

It's hard to tell where the name begins and the random numbers and letters start...

Street Price \$20 Supplier Coolermaster  
Website [www.coolermaster.com](http://www.coolermaster.com)

**R**eviewing mouse mats... it can seem pointless at times. When you get down to it, any product that can adequately replaced with a manila folder, a pair of rubber breasts or simply not used at all has a lot to accomplish if you're actually going to spend money on one. But Coolermaster wants you to do just that, and we're willing to give its new range of Storm Tactics pads a whirl.

The pads – and there's a lot in the range besides the one reviewed here – are all military themed, and designed to more or less match Coolermaster's Storm range of cases. The M4 DM looks the business, at least, with a Colt M4 carbine in strong blacks over a nicely graded grey and white background. It's reasonably thin, for a gaming pad, coming in at about 4mm thick. The upper surface is a relatively rough cloth weave, and it's backed by a non-slip rubber underlay.

In practice, it's a pretty good mouse pad, working very well with laser mice. The cloth

surface looks like it can take some punishment, and it doesn't impede good mouse action. There are smoother pads out there, but this one offers a pleasing level of resistance, and therefore better fine position feedback. And that rubber base really is sticky – even the most frantic fragging won't shift it. In the training level of CoD 4, our mousing was as smooth and accurate as we could hope for, and maybe even a little more accurate.

Like mice, of course, the choice of mouse mat is a pretty individual one, but Coolermaster's thought of that, too. Each of its new mats features a small swatch of the surface material on the box itself, so it's easier to work out if a particular pad is your cup of tea.

There's a size for every gaming area, too, and there's even a plastic-topped rigid pad. We'll be looking at that next issue.  DH



# Logitech G13 Gameboard

Only for the gadget obsessed.

Street Price \$120 Supplier Logitech  
Website [www.logitech.com.au](http://www.logitech.com.au)  
Gallery [www.atomicmpc.com.au/?149701](http://www.atomicmpc.com.au/?149701)

**W**hat do you get for the gamer who has everything? We'd guess one of these Gameboards, with its array of ergonomic keys, thumb-stick and handy LCD screen, might do the trick.

The G13 is pretty much a glorified keyboard when you get down to it, with 22 configurable keys, four memory presets, two thumb keys and a neat little joystick. The LCD screen is much the same as that on previous Logitech keyboards, and can be set up to show game stats (though, that's what most games do already), RSS feeds or CPU and drive status. It's kinda neat watching your cores on a multi-core system power up and down, but whether it's actually useful or not is a matter for debate.

But the meat and potatoes of the G13 is in the gaming, and the only way to test that is to game. It's a hard life, but we do our best.

We loaded up the killhouse training level of Call of Duty 4, and got to it. The rubber handrest is very comfortable, and the G13 grips the desktop very solidly. It also configures

itself for most games you can throw at it, and opening up the G13 utility showed is it had done just that. Our first few run-throughs were problematic, as we learnt the new keymapping, but once we got that down the time to complete dropped by a couple of seconds.

It was a good result in terms of movement, but we also found that it was seriously throwing our aim off; when set up to the left (we're right-handed) of the keyboard, it means your two hands are further apart than normal by about six inches. Consequently, our mousing was compensating to the left! Shifting the keyboard aside fixed this issue.

The G13 works, but whether it works enough is hard to quantify. For one thing, it throws out pretty much any hint systems a game may have, as they're all written for a conventional keyboard, not the G13's keys G1 through G22. It's takes up more space, too, and needing to move your keyboard aside for optimum performance is a hassle. When you consider that necessity of text chat in many games, it's a further complication.

Despite the improvement in movement, we still prefer the classic WASD set up on a good



keyboard over the experience the G13 offers. It may well be perfect for some gamers, but it's not quite perfect enough for us.  DH



# Corsair Hydro Series H50

A mini kit that actually works?!?

**Street Price** \$118 **Supplier** Corsair  
**Website** [www.corsair.com](http://www.corsair.com)

**Specifications** Sealed watercooling loop, 120mm aluminium rad, 120mm fan included, LGA775/1136.

Watercooling is slowly dribbling into the mainstream enthusiast crowd, being readily accessible from online stores and how-to guides, but the one bugbear that has stuck around is the typically poor performance of single-rad kits like this one. A single 120mm aluminium radiator and fan, pre-connected and filled tubing, and a simple copper waterblock (galvanic corrosion is something to be mindful after a few years' running), with pump mounted on top – easy to guess why this doesn't usually compare to 360mm radiators and custom kit.

However the H50 isn't terrible; everything from the easy mounting system to the performance was a nice surprise. Long screws mount through the back of a case to bring the 120mm fan and radiator together (exhausting

at the rear), and a bracket secures onto either a LGA775 or 1366 socket, into which the block/pump combo slots in and screws firmly against the CPU. Thermal goop is even pre-applied in a thin coating, making it just that much easier. The waterblock has a mirror polish, and was smoother than silk.

Power to the pump is supplied through a normal 3-pin fan connector, and while it made a small rushing noise as it was turned on the first time, it was practically silent in use. The included fan made an idle of 56.7dBA and a load of 59.2dBA – but this is easily replaceable with your favourite fan if lower noise is needed. If nothing else, it looks awesome when installed!

Performance was surprisingly good for such a small loop, passing our torture test with a i965 just fine even when overclocked. Overclocking is definitely possible with this cooler; but at a pricetag of \$118 you'll be buying it for the cool factor, not the performance (especially compared to the \$52 Aywun A1-V8 in Kitlog).  JR



**Overall**  
Nice performance, but can't beat a good ol' heatsink.

**76%**

	Load	Idle
3.2GHz, 1.2V	55	36
3.6GHz, 1.35V	63	37

# PC Power & Cooling Silencer 910

Keeping it simple.

**Street Price** \$289 **Supplier** OCZ  
**Website** [www.ocztechnology.com](http://www.ocztechnology.com)

**Specifications** ATX form factor; 24-pin, 4-pin ATX, 8-pin ATX, 7x molex, 12x SATA, 2x 8-pin PCIe, 2x 6-pin PCIe.

PC Power & Cooling has been a much-respected player in the PSU scene for quite some time, and while its designs have never been considered 'flashy', the company's straightforward build and reliable performance has been something that has lured many an enthusiast. It turns out however, that simplicity itself eventually reaches a point where it begins to complicate things.

Built into the familiar elongated ATX standard, this PSU is coated in a matte black colour with a simple blue sticker on it. Cooling duties are performed by a single 80mm fan at the front of the unit, and while this is much less than other designs it never became loud nor had excessively hot air exhausting from it, managing the load quite well. A hard power switch at the front is another notable feature, while small vents along the body of the unit allow air to enter.

Keeping the simplicity in mind, this is not a

modular power supply – but with seven molex connectors, twelve SATA, two 8-pin and two 6-pin PCIe on top of the usual 24-pin, 8-pin and 4-pin ATX power connectors – this means one huge amount of cable. Sure they're all sleeved nicely, but there's physically nowhere to place them once in a case if they're not needed, and removal is impossible. The cables are also kind of short; large cases will run into problems.

Performance however was rock-solid, with an idle reading on the 12v rail of 12.278v and a load of 12.268v, a very respectable result. The 5v line wavered a little from 5.180v idle to 5.192v load, but this is again quite good. A beefy single +12V rail at 74A continuous gives 888W – meaning this PSU lives up to its name. It's got a few drawbacks, and is expensive for what you get, but you won't be disappointed with performance.  JR



**Overall**  
Reliable and steady power, not modular, five year warranty.

**80%**

# Dragonlord PC-K62

Lancool knocks our socks off with its relaunched case line.

**Street Price** \$199 **Supplier** Mittoni

**Website** [www.lancoolpc.com](http://www.lancoolpc.com)

**Specifications** 214x496x498 (WxHxD); 5x 5.25in drive bays, 4x 3.5in drive bays; 1x 140mm fan (front), 2x 140mm fan (top), 1x 120mm fan (rear); 2x USB 2.0, 1x HD+AC97; ATX, mATX; 8mm SECC; side-panel window.

Lancool is the cheap and cheerful division of Lian Li, providing budget-grade cases for gamers and short-on-cash enthusiasts. Given that they often have a lot of Lian Li touches, the cheaper aspects of the Lancool range tend to grate on us – but not so with the new Dragonlord. The name might be a bit laughable (or incredibly awesome!), but we're dead serious about how good this case really is.

The external design has just enough flair to set it apart from the usual case crowd, with a mesh-fronted fascia and clear side-panel window. A plastic grill on the case's top adds more visual impact, while also protecting two 140mm LED exhaust fans. There's another 140mm LED fan at the front, as an intake, and further 120mm fan at the rear. The intake is protected by a removable filter, as are all the grills covering the 5.25in bays. That's pretty impressive itself; Lancool hasn't stopped there, though, and each fan is vibration-dammed by rubber grommets.

Removing the sidepanels reveals even more sound damping measures. The PSU rests on a raised pair of rails, with rubber pads. The PSU itself is secured by a locking metal bar, again lined with rubber. An intake in the case's bottom accommodates PSU's with fans underneath, and this too is protected by a filter.

The HDD cage gets some rubber-loving, too, with each drive locked into a caddy with

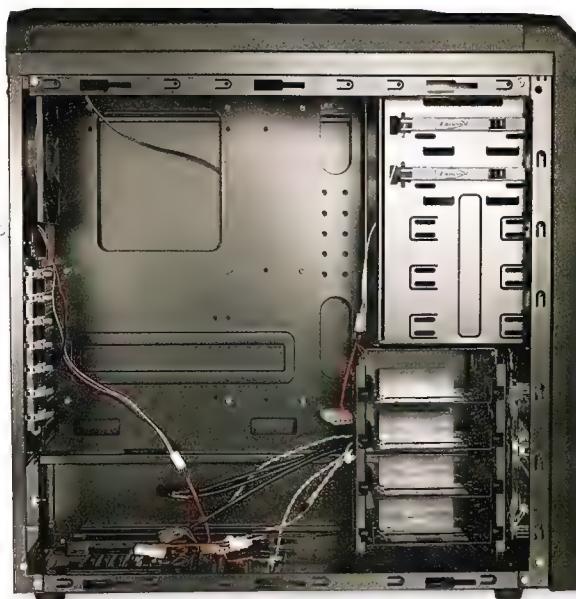
rubber grommets that slide into the bay, before a screw-secured locking mechanism latches them in place. There's even a peel-off sheet of rubber pads to ensure your optical drives and other 5.25in devices don't spoil the quiet party. The effort put into noise reduction is bloody impressive. But that's not the Dragonlord's best trick by a long shot.

Like many other case-builders, Lancool has opted for a tool-less design to secure expansion cards. Unlike many other case-builders, Lancool's system works. Once again, rubber pads play a big part, alongside a two-stage latching mechanism that is the most secure we've seen – even large multi-GPU monsters will be safe in this system's rubber hands.

Cable management is pretty solid, though a touch cramped. There's not quite enough room behind the mobo plate to run cables, though there are passthroughs if you want to try. There is a neat plastic cable-run system on the case's bottom plate, and that'll help, but you'll still need to be judicious with the cable ties if you want to take advantage of the Dragonlord's excellent airflow.



About the only real downer with this case is its structural quality. There's a lot of travel in the chassis, and it doesn't take a lot of weight to warp the case out of true. This isn't an issue if your case is staying put once built, but it does rule it out if you frequently tote your rig to LANs. That aside, this isn't just the best Lancool case we've seen, but one of the best cases we've seen for this price. Period. 



**Build**  
Adequate for a static build.

**Value**  
A lot of quiet bang for your buck.

**Cooling**  
Excellent, and well sound-proofed.

**Features**  
The best tool-less options we've seen.

**Overall**  
One of the best cases in the \$200 bracket.

**79**

**91**

**92**

**95**

**91%**

# GMC R4 Bulldozer

It's a neat gimmick of a case, but is the gimmick worth it?

**Street Price** \$150 **Supplier** Also Technology

**Website** [www.alostech.com.au](http://www.alostech.com.au)

**Specifications** 180 x 420 x 380mm (W x H x D); 1x 92mm blue LED Fan (front); 1x 80mm fan (side); 1x 120mm fan (rear); 1x 5.25in drive bay (external); 2x 3.5in drive bay (internal); ATX, M-ATX; steel.

**Gallery** [www.atomicmpc.com.au/?149187](http://www.atomicmpc.com.au/?149187)

**R**eviewing anything can get a little repetitive after a while, and that's especially true of PC cases. They're empty boxes, effectively, and even a really good case and a really bad case are going to be essentially the same in many ways. So when a unique take on the standard design comes along, like this plastic-fantastic effort from GMC, it's easy to get excited.

First things first – we admit, the faux-industrial aesthetics of the R4 Bulldozer are not for everyone. Personally we really don't mind the hydraulic superstructure look – but then we're also tempted to take to the R4 with a lot of paint and modelling putty to really amp up the industrial feel. Suffice to say you'll either love it or hate.

You'll either love or hate the optical drive mechanism, too, which takes the ODD out of the case entirely, and mounts it in a downward orientation. Combined with a plastic cover, in operation the Bulldozer looks much like its namesake, pistonning open and shut. It's kinda neat, but, like a lot of the R4's build, also kinda flimsy. The latch that triggers the opening mechanism is asking to be snapped off, and is easy to get out of working position.

That sense of cheapness occurs elsewhere as well, but never in so nasty a case as the thumb screws securing the sidepanel – they're plastic!

The screw itself is metal, but the thumb portion is very weak plastic that looks like it can't wait to come loose. The side protrusion on the panel is also plastic, as are all the fancy fake support struts on the case's front.

This is not a sturdy LANing case, despite its size!

With the side-panel removed, we're treated to a pretty standard interior. The metal is untreated, and often flimsy, but with the ODD out of the interior, there's at least a lot of room. You'll need that room, too, as there's no real cable management to speak of. The HDDs mount vertically, again saving some room, and the PSU is mounted on the top of the case.

In theory, that leaves a mess of room for expansion cards. You can fit in a lot of the modern dual-slot cards, but only if you don't want them to power on – any card with its power connectors facing back into the case simply won't fit. We'd recommend something in the realm of a 9800GT, and no larger.

Anyway, anything too modern, and you'd run the risk of stretching the 120mm and two 80mm fans to their limits. Given the space, cabling's going to block a lot of airflow, so temp management will be tricky at best.

At the end of the day, if this case were about \$120 or so, we might be able to like it more, but at \$150, it's just too much to ask for too little quality. Unless you like the whole industrial thing...  DH



<b>Build</b> Imaginative, but very flimsy.	68
<b>Value</b> Too much for too little.	58
<b>Cooling</b> Adequate for basic gear. Zero overclocking potential.	74
<b>Features</b> Some cute space saving ideas.	73
<b>Overall</b> A case that's quirky at best, and not for everyone.	66%

# Thermaltake Element G

Not Thermaltake's finest moment...

**Street Price** \$200 **Supplier** Anyware

**Website** [www.thermaltake.com](http://www.thermaltake.com)

**Specifications** 230 x 480 x 521mm (W x H x D); 1x 200mm Fan (front); 1x 140mm Fan (top); 1x 140mm Fan (rear); 1x 200mm Fan (side window); 3x 5.25in drive bay (external); 7x 3.5in drive bay (internal); 2x 2.5in drive bay (internal); ATX, M-ATX; SECC Steel with meshed panel.

**Gallery** [www.atomicmpc.com.au/?150397](http://www.atomicmpc.com.au/?150397)

There's a lot of competition in the mid-range enthusiast market, and probably one of the more bitter rivalries is between Thermaltake and Coolermaster. The two case makers seem hell-bent on out-specing, out-designing and even out-pricing one another. The latest effort from Thermaltake, the Element G, seems to be as much a victim of the conflict as it is the company's latest weapon.

Our mixed feelings started pretty much when we unboxed the case. The matte-black is attractive, but also surprisingly easy to fingerprint, while at the same time being rather hard to clean. Grubby-handed gamers beware. There's also the red-trim, which looks striking on the box art, but in real life actually looks on the cheap side, detracting from what is an otherwise solidly designed fascia. There's plenty of IO options, including four USB ports on the front edge, and the power and reset buttons feel well-constructed and solid.

There's certainly a lot of good cooling options in the Element G. It comes stock with a side-mounted 200mm fan, and 140mm fans in the top and rear. There's also mounts for more fans, as well as concessions for water-cooling your rig if that's your thing. None of the fans offer any filtering beyond the metal mesh, though; it'll stop large items like curious fingers and case screws, but pet fur and dust will sail right on through. At

least Thermaltake's using its brain with the side-panel fan power connector – it's the same conductive pad system used in the excellent Spedo case ([www.atomicmpc.com.au/?139103](http://www.atomicmpc.com.au/?139103)).

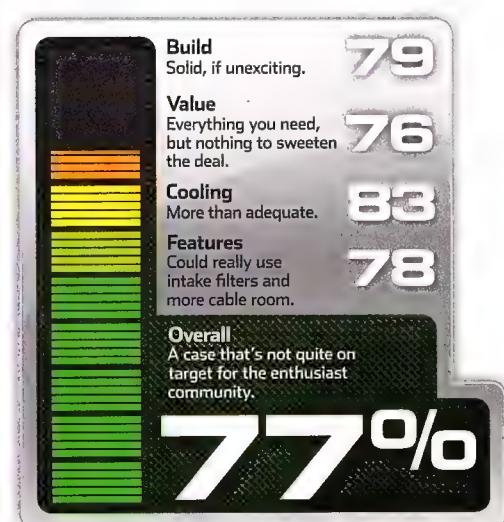
With the side panel removed, we get to enjoy the sparse all-black interior of the G. And it's sparse in a good way – there's no fancy tool-less system for expansion cards, thankfully! With larger dual-slot graphics cards, most tool-less systems simply aren't adequate for holding that much weight, putting undue stress on the PCI-e connections. Pretty much everything else screws in, too, though there's nothing in the way of sound-dampening present.

There's some effort put into cable management, too, but it seems half-hearted. The clips to route cables through are very lightweight, and there's simply not enough room



behind the mobo-plate to run even an 8-pin power cable.

All up, it's quite the mixed bag from the Element G. It's simple and austere in a good way, but lacks even the most basic of enthusiast-grade concessions. It just doesn't quite have the edge to make it for the serious Atomican.  DH



# BIG ASS CPU Roundup

James Gobold and Antony Leather smack forty CPUs into submission.

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**A**lthough a PC is a complex system of multiple intercommunicating components, the CPU has a principal role to play in almost every aspect of your PC's performance. Whether you're a keen gamer, a 3D modeller or animator, video maker or simply want a good all-round PC, it's crucial that you choose the correct CPU.

This is why Atomic has rounded up all the best CPUs available on the market and benchmarked them against each other to find out which is right for you. This Head2Head encompasses 40 different CPUs split across five major platforms - AMD Socket AM2, AM2+ and AM3, plus Intel LGA771, LGA775

and LGA1366. As there's now such a plethora of different platforms, we decided not to review any dual-processor configurations, with the exception of the LGA771 Skultrail platform.

This allowed us to focus our attention on the single-processor market, which gave us more time to overclock each CPU and report on our findings. We've pushed each chip as far as they'll go, and we'll also do this once Intel has released its next-generation Nehalem-based Xeons; if you're planning on building or buying a new workstation/server/folding farm then it's definitely worth holding on a little longer.

In the meantime, the following pages will help you to determine which of the current 40 CPUs is right for your next upgrade/build.

# HOW WE TESTED

The three most important characteristics of a CPU are performance, price and power consumption. The importance of performance is obvious - clearly, nobody wants to sit around waiting for their PC to complete tasks, or suffer through stuttering games. So for this roundup, we devised multiple methods of measuring each CPU's performance.

Although we had to build multiple different configurations to test each of the five platforms represented, we tried to use the same core components in each rig. This included a 250GB Samsung SpinPoint P120S hard disk, Windows Vista 32-bit and a Zotac GeForce 260 AMP! graphics card. The Socket AM2 and AM2+ CPUs were tested in an MSI DKA790GX Platinum motherboard and the Socket AM3 CPUs in a Gigabyte GA-MA790FXT-UD5P motherboard. The LGA775 CPUs were tested in a Biostar TPower i45 motherboard, the LGA771 CPUs in an Intel D5400XS motherboard and the LGA1366 CPUs in an Asus P6T Deluxe motherboard.

We started testing by running our Media Benchmarks, which comprises three separate tests. The first test assesses the ability of the PC to edit high-resolution digital photos, while the second test encodes an MPEG-2 video into H.264. The third test multitasks between compressing a huge file archive and playing the video file created by the second test. The scores from these tests are shown relative to a Core 2 Duo E6750, which scored an arbitrary 1,000.

As it's almost impossible to buy a single-core CPU now, programmers have finally got their act together and started writing multicore friendly games. We didn't want to just cover one game genre, so we selected three very different games. Crysis is a popular 3D shooter and one of the most resource-hungry games created. We also tested each CPU running Flight Simulator X and X3: Terran Conflict, two open-ended world simulators; the former is set in the very mundane world of civilian aircraft simulation, while the latter takes place in the far reaches of outer space. We measured the minimum and average frame rates



in each game, but focused our attention on the minimum frame rate - even if the game is running at a high average frame rate, the human eye will perceive any drop below around 25fps as jerkiness, ruining your enjoyment of the game (and killing a few kittens along the way).

Not forgetting the many 3D professionals who need serious CPU grunt, we also ran the CPU-rendering test within Cinebench R10. This multithreaded test ray-traces a high-resolution image of a motorcycle using the same rendering engine as Cinema 4D, a popular 3D animation and rendering package used by game developers and film studios.

For those who are more interested in the pure number-crunching power of each CPU, we ran WPrime 32M, which calculates the square root of prime numbers.

This is a totally synthetic benchmark, but it's very popular among extreme overclockers.

We also overclocked each CPU to its maximum stable frequency with a standard off-the-shelf air cooler. Due to the way they're made, some CPUs

may overclock differently from our samples, but these figures will still give you a good target for which to aim when overclocking at home.

As the cost of electricity rises and it becomes increasingly hard to cool hot-running CPUs, we also measured the power consumption of each CPU. As there are so many different competing platforms with different memory controllers and memory technologies, the only fair way to compare power consumption is to measure the power draw of the entire PC at the wall. From these figures, we derived a 'performance per watt' rating for each CPU.

Using an abacus and three yards of parchment, we divided the average performance of each CPU by its price to calculate its value for money - we call this its 'bang per buck'. Where possible, we used the prices listed on

StaticICE ([www.staticice.com.au](http://www.staticice.com.au)) to avoid the problem of recommended retail prices - these are closer to what you'd pay on the street. As Core i7 and LGA771 motherboards are so expensive, the prices we used in this calculation also include the same motherboard and RAM we used to test each CPU, allowing you to make a fair assessment of the value of the whole platform, not just the CPU in isolation.

In addition to all these graphs, you'll find two final graphs that rank each CPU's performance in our Media Benchmarks and three games according to its price, allowing those on a fixed budget to choose the best value upgrade.



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I/O Ports	USB 2.0 x 2 / HD+AC97 Audio
Dimensions	214 x 496 x 498 mm (W, H, D) PC-K58/K56W: 210 x 480 x 490 mm (W, H, D)

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## Intel Celeron

Stunning overclockers, but the small L2 cache results in mediocre performance

Very overclockable; very cheap

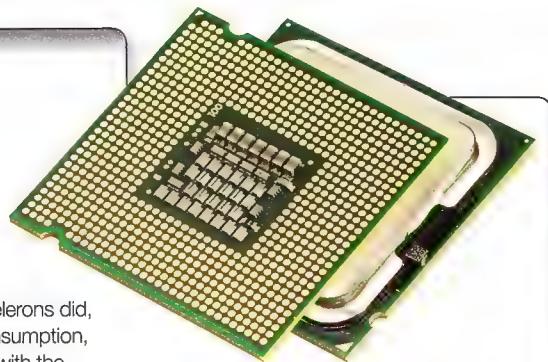
Poor performance at stock speeds; severely limited by the tiny L2 cache

Intel's dual-core Celeron E1200 and E1400 are the cheapest CPUs in its current range. They might seem like a bargain compared with CPUs such as the Core 2 Duo E8400 or Core 2 Quad Q6600 if you're building an LGA775-based system, but there are a few things you should know before reaching for your wallet.

Both CPUs have just 512KB of Level 2 cache shared between their two cores. Due to this small cache, and their snail's-pace clock speeds (1.6GHz and 2GHz), both models delivered pretty dire results at stock speeds in all of our tests. They were the slowest CPUs on test, with an overall score in our Media Benchmarks of 491 for the

E1200 and 581 for the E1400. The Celerons did, however, exhibit the lowest power consumption, with the entire system drawing 133W with the E1200 installed and 137W with the E1400 installed.

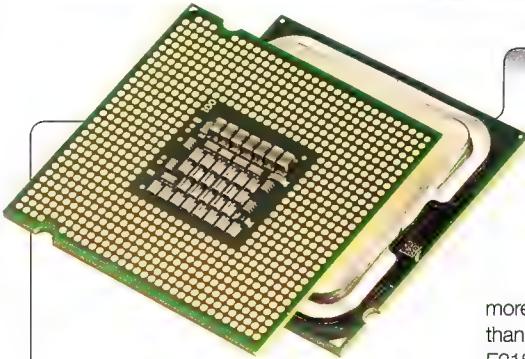
However, it isn't all doom and gloom. The E1200 and E1400 are stunning overclockers - the 1.6GHz E1200 even came close to an eye-popping 100 per cent overclock, reaching 3.12GHz with a vCore of 1.55V, which is still well within the limits of a good air cooler. In the Media Benchmarks, the image editing and video encoding tests saw particularly big score increases; the E1200's overall score increased to 833 and the E1400's to 957 - only slightly slower than that of the E8400, which costs over



\$220. Most notably, the E1400 gave many of the stock speed Core 2 Quads a run for their money in Crysis and Flight Simulator X.

At stock speeds, the Celerons' performance is as insignificant as their price. They overclock incredibly well, but you'd need to accompany them with a good overclocking motherboard and RAM (in other words, expensive) to get the most out of them. As such, you'd be better advised spending a little more on your CPU and buying a Pentium E5200 instead (see below).

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	Effective FSB	Cache	Price
Celeron E1200	LGA775	1.6GHz	3.12GHz	Allendale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 512KB	\$95.00
Celeron E1400	LGA775	2GHz	3.5GHz	Allendale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 512KB	\$70.00



Despite having a name harking back to the days when the frequency of processors was in double figures, Intel's latest Pentium CPUs are cut-down Core 2 Duo CPUs. As such, despite their smaller Level 2 cache and lower clock speeds, they're still fairly potent and more importantly, very good overclockers.

The E5200 has a 45nm Wolfdale core and 2MB of L2 cache, while the E2180, E2200 and E2220 CPUs have a 65nm Allendale core and 1MB of L2 cache. Strangely, the

more potent E5200 is actually priced lower than the slowest Pentium CPU on test, the E2180, so we'd suggest that the E5200 is the only Pentium CPU on sale at the moment that's worth considering. It stacks up well against the cache-laden brethren of the Core 2 Duo series too. Despite selling for \$110 less than the Core 2 Duo E8400, the E5200 recorded an overall score in the Media Benchmarks of 825 while the E8400 scored 1,071.

In games, the E5200 was again very quick, although it was noticeably slower than the E8400; in Flight Simulator X, the latter managed a minimum frame rate of 15fps while the E5200

could only muster 12fps. Crysis proved to be even more of a challenge - the E5200's minimum frame rate of 22fps was totally eclipsed by the 35fps recorded by the E8400.

We managed to overclock the E5200 to an impressive 3.75GHz. The overall Media Benchmark score rose from 825 to 1,208, which is faster than a Core 2 Quad Q9450. Crysis saw a marked improvement, with the minimum frame rate increasing from 22fps to 35fps.

The E5200's fantastic value makes it stand out - when overclocked, it can keep up with many of the Intel Core 2 Quads, an outstanding accomplishment for a CPU \$110.

## Intel Pentium

Ain't nothin' quite like a cheap CPU

Excellent value; very overclockable

Slow at video encoding; E2100 and E2200 models are slow at stock speed

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	Effective FSB	Cache	Price
Pentium E2180	LGA775	2GHz	3.3GHz	Allendale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 1MB	\$116.00
Pentium E2200	LGA775	2.2GHz	3.4GHz	Allendale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 1MB	\$135.00
Pentium E2220	LGA775	2.4GHz	3.5GHz	Allendale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 1MB	\$135.00
Pentium E5200	LGA775	2.5GHz	3.75GHz	Wolfdale	2 x physical	800MHz	2 x L1 = 32KB, L2 = 2MB	\$110.00

# Intel Core 2 Duo

Untouchably exceptional overclockers

- + Very overclockable; gives Core i7 CPUs a run for their money in games
- Much slower than Core 2 Quad CPUs at video encoding and 3D rendering

Intel's LGA775 Core 2 Duo E8000-series CPUs based on the 45nm Wolfdale core have proven to be worthy successors to the E6000-series CPUs, which were very popular a few years ago. Their large 6MB of L2 cache, faster stock speeds and lower prices compared with Core 2 Quad CPUs mean that the E8000-series CPUs are perfect for a gaming system, despite only having two cores.

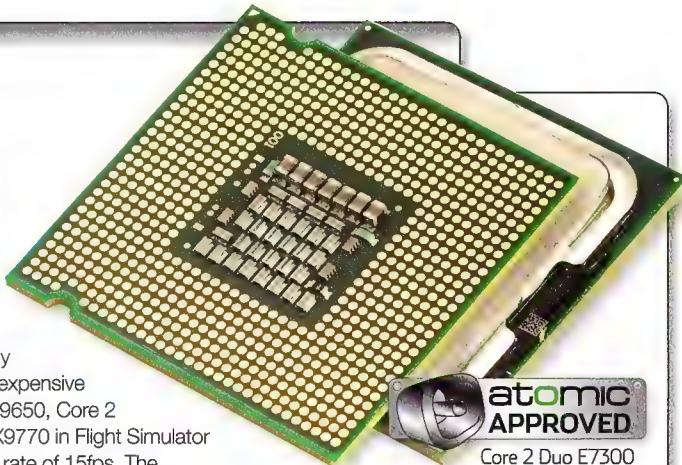
With a maximum TDP of just 65W, they can be quite easily tamed with good air cooling, even when overclocked. The latest E0-stepping variants are even better overclockers than original C0-stepping CPUs too. Intel also produces a range of cut-down Core 2 Duos; the E7300 has 3MB of Level 2 cache and is clocked at 2.66GHz but it's considerably cheaper at \$215.

Out of the box, the 3GHz E8400 was faster than any of the Core 2 Quads and all AMD CPUs in the image editing test, and even managed to match the Core i7-920 with its score of 1,135. The E7300 fared slightly less well, recording a score of 984, but it was still

faster than any of the AMD CPUs.

It was a similar story in games. The E8400 only succumbed to the more expensive Core i7s, Core 2 Quad Q9650, Core 2 Extreme QX9650 and QX9770 in Flight Simulator X, with a minimum frame rate of 15fps. The E7300 managed to produce a minimum frame rate of 16fps, and was only bettered by a handful of far more expensive Intel CPUs. The E8400 recorded a minimum of 35fps in Crysis - only the i7-940 and i7-965 Extreme Edition were faster. The E7300 lagged behind with a minimum frame rate of 27fps, but this was still faster than many of the more expensive Core 2 Quad CPUs and the majority of the offerings from AMD.

We managed to overclock the E8400 and E8500 to 4.4GHz, the E8600 to 4.5GHz and the E7300 to 4.2GHz by raising the vCore of each CPU to 1.45V. In our Media Benchmarks, the overclocked E8400 proved to be faster than all the overclocked Core 2 Quad CPUs, except for the Q9650, with an overall score

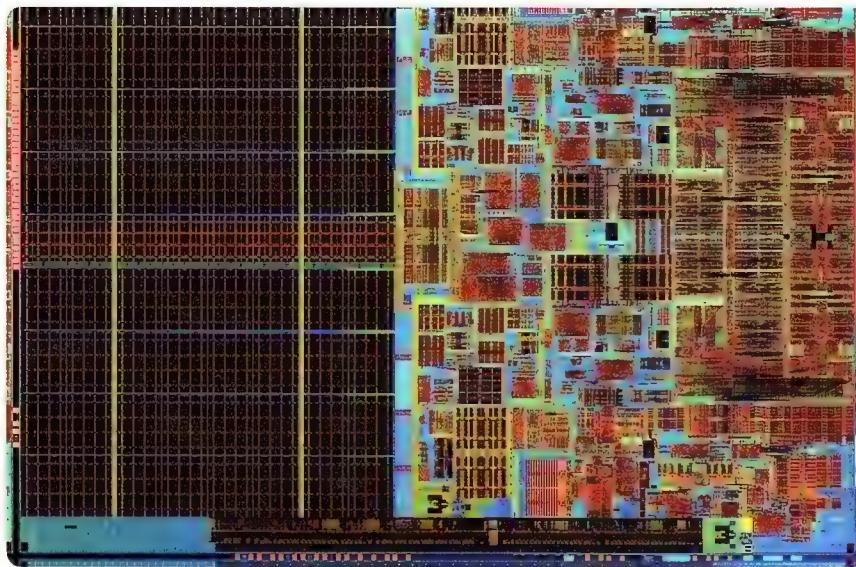


**atomic APPROVED**  
Core 2 Duo E7300

**atomic APPROVED**  
Core 2 Duo E8400

of 1,477. The overclocked E7300 recorded an equally impressive score of 1,433. The overclocked E8400 was also a match for the more expensive Intel CPUs in games, with a minimum frame rate of 35fps in Crysis and 52fps in X3: Terran Conflict, while the overclocked E7300 recorded similar minimum frame rates of 36fps in Crysis and 48fps in X3: Terran Conflict. The overclocked CPUs' minimum frame rates in Flight Simulator X of 18fps for the E8400 and 19fps for the E7300 were the only letdown, with many of the overclocked Intel Core 2 Quads managing slightly better frame rates. The Q9650, for example, achieved a minimum frame rate of 22fps, showing that this multithreaded flight sim will run slightly smoother on quad-core CPUs running at the same frequency.

The only drawback of these superb CPUs is their performance in heavily multithreaded applications. The video encoding test and Cinebench in particular show what an additional two cores can do. For example, the E8400 scored 1,279 in the video encoding test while the Q9650 managed a lofty 1,732. While the performance lead of the Core 2 Quads and Phenom II X4 CPUs is undeniable in these applications, the E8400 in particular is far cheaper, more overclockable and was more than a match for any other CPU in most of the game tests, including the Core i7 CPUs. In the bang per buck and price/performance stakes the E8400 is simply amazing value, and for most readers is the CPU we'd recommend buying.



Core 2 Duo was overshadowed by Core 2 Quad in 2008, but thanks to its brutally efficient architecture and high frequency it's set to make a comeback in 2009.

CPU	Packaging	Frequency	Maxoverclock	Core	Number of cores	Effective FSB	Cache	Price
Core 2 Duo E7300	LGA775	2.66GHz	4.2GHz	Wolfdale	2 x physical	1,066MHz	2 x L1 = 32KB, L2 = 3MB	\$215.00
Core 2 Duo E8400	LGA775	3GHz	4.4GHz	Wolfdale	2 x physical	1,333MHz	2 x L1 = 32KB, L2 = 6MB	\$220.00
Core 2 Duo E8500	LGA775	3.16GHz	4.4GHz	Wolfdale	2 x physical	1,333MHz	2 x L1 = 32KB, L2 = 6MB	\$249.00
Core 2 Duo E8600	LGA775	3.33GHz	4.5GHz	Wolfdale	2 x physical	1,333MHz	2 x L1 = 32KB, L2 = 6MB	\$365.00

## AMD Athlon X2

Aging architectures aren't awesome

- + Inexpensive; gives Phenom X3 a run for its money
- Lousy overclocker; poor performance even when overclocked

AMD's dual-core Athlon 64 X2 CPUs were first released for Socket 939, but later AMD changed them to Socket AM2 to add support for DDR2. Later still, AMD dropped the '64' from the name for some unknown reason. However, these once great CPUs (they were considerably superior to Pentium 4 and Pentium D) are now well past their prime.

Although AMD has discontinued much of the series, we managed to find a number of different Athlon X2s on sale. These range from the \$120 2.5GHz 4850e based on the 65nm Brisbane core to the \$108 2.7GHz 7750 Black Edition, which sports an unlocked multiplier, 2MB of shared Level 3 cache, a higher TDP of 95W, is Socket AM2+ and based on the Kuma core. In short, the 7750 Black Edition is a Phenom X2 in all but name.

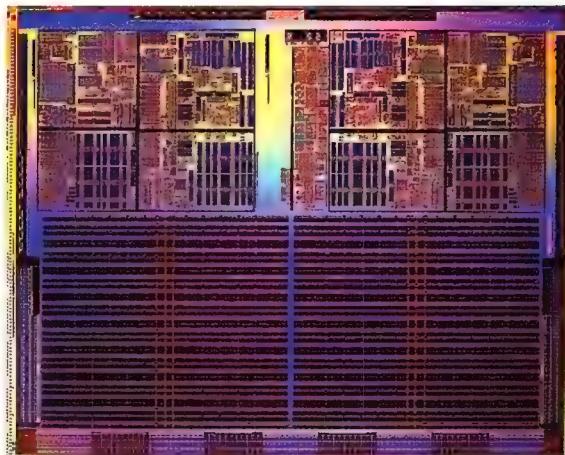
At stock speeds, all the Athlon X2 CPUs' performance levels were in the lower half of the Labs test, with the Intel Celerons bringing up the rear. With the 4850e installed, our test system drew just 137W, one of the lowest values recorded, while the 7750 Black Edition consumes significantly more - our

system drew 184W with it installed. The Athlon X2's overall scores in the Media Benchmarks ranged from a very poor 673 for the 4850e to 830 for the 7750 Black Edition. In all fairness, the 7750 Black Edition's score isn't bad considering its price. All the Phenom X3s performed worse despite having an extra core and retailing for up to \$70 more.

The Athlon X2 CPUs also showed up the more expensive and more modern Phenom X3 CPUs in games. The 4850e managed a minimum frame rate of 8fps in Flight Simulator X, with the 7750 Black Edition achieving 11fps, while the Phenom X3 8750 Black Edition could only manage 10fps. The same situation presented itself in Crysis, with the 7750 Black

Socket AM2 system, it's worth considering the competition too. Intel's Celeron and Pentium-series' are just as cheap (even more so in some cases) as these budget Athlon X2 CPUs. The CPUs return similar overall Media Benchmark scores, with the 7750 Black Edition scoring 830 and the E5200 scoring 825; performance was also similar in the game tests.

**The only situation in which we'd recommend buying any of them is if you're upgrading a slower Socket AM2 system...**



Dual-core Athlon X2s were the chips to buy in 2005, but they're now well past retirement age.

Edition matching the Phenom X3 8750 Black Edition's minimum frame rate of 22fps; the 4850e brought up the rear with 17fps. X3: Terran Conflict was a similar story; the 7750 Black Edition was again the fastest, with a minimum frame rate of 26fps compared to the 25fps recorded by the Phenom X3 8750 Black Edition. The 4850e was considerably slower, managing a minimum frame rate of just 21fps.

Athlon X2 CPUs appear to be better value for money than Phenom X3s, but if you're building a new PC rather than upgrading an existing

If you're clued in on overclocking, however, the situation becomes pretty terminal for the Athlon X2 CPUs. Once the E5200 had been overclocked to 3.75GHz, it simply walked all over the Athlon X2 CPUs in every test, scoring 1,208 overall in the Media Benchmarks, while drawing less power than the 7750 Black Edition at stock settings.

AMD's Athlon X2 CPUs are past their prime, even when overclocked. The only situation in which we'd recommend buying any of them is if you're upgrading a slower Socket AM2 system on a tight budget, as they're much better value than any of the Phenom X3 or Phenom X4s. However, if you're building a new PC then the E5200 costs roughly the same amount of cash, performs very similarly out of the box and is much better when overclocked. ☺

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	HTT	Cache	Price
<b>Athlon X2 4850e</b>	Socket AM2	2.5GHz	2.93GHz	Brisbane	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB	\$120.00
<b>Athlon X2 5050e</b>	Socket AM2	2.6GHz	2.93GHz	Brisbane	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB	\$92.00
<b>Athlon X2 5400+</b>	Socket AM2	2.8GHz	3.15GHz	Brisbane	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB	\$125.00
<b>Athlon X2 5600+</b>	Socket AM2	2.9GHz	3.15GHz	Brisbane	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB	\$130.00
<b>Athlon X2 6000+</b>	Socket AM2	3.1GHz	3.3GHz	Brisbane	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB	\$135.00
<b>Athlon X2 7750 Black Edition</b>	Socket AM2+	2.7GHz	3.1GHz	Kuma	2 x physical	200MHz	2 x L1 = 128KB, 2 x L2 = 512KB, L3 = 2MB	\$108.00

# Intel Core 2 Quad

Quadcore is still where it's at!

- + Great for multitasking and media encoding
- Most of the 45nm models are poor overclockers

All Core 2 Quads are LGA775 processors, but there are currently two different types within the series. The Q6600 is the oldest model, dating back to December 2007, and is based on the 65nm Kentsfield core. Despite a shift in early 2008 from the B3 to the G0 stepping, the Q6600 runs a lot hotter and consumes much more power than other Core 2 Quads, which is due to the 45nm Yorkfield core. The Yorkfield core models are also slightly faster clock for clock, as they're based on the enhanced Penryn architecture.

The Q6600 is clocked at 2.4GHz, with a 1,066MHz effective FSB. Each of its pair of cores has 4MB of shared Level 2 cache. Despite its higher model number, the next model up, the Q8200 runs slightly slower (2.33GHz), and has a 1,333MHz effective FSB and just 2MB of Level 2 cache per pair of cores. As such, it underperforms the Q6600. The next model up from the Q8200, the Q8300, is clocked at 2.5GHz and has the same cache configuration, so it performs very similarly to the Q6600. The Q9300 is also clocked at 2.5GHz, but has a little more Level 2 cache (2 x 3MB), resulting in slightly higher performance in Cinebench - but precious little else. The Q9450, Q9550 and Q9650 all have 6MB of L2 cache per pair of cores, and are clocked at 2.66GHz, 2.83GHz and 3GHz respectively. The 45nm transistors found in the Q8300 and above are much more energy-efficient than the 65nm transistors in the Q6600, which draws the same amount of power as the far faster Q9650.

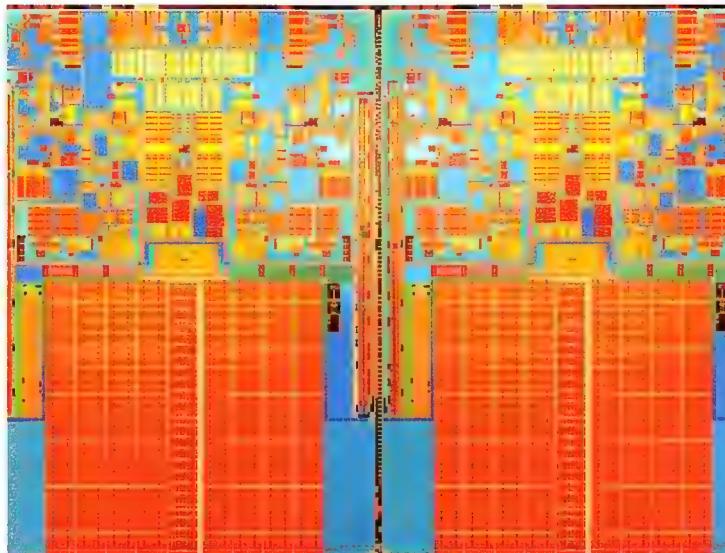
Despite their 45nm transistors and lower operating voltages, with the exception of the Q9650, none of the other Core 2 Quads proved to be particularly good overclockers. Most wouldn't benchmark stably above 3.3GHz, with the Q8200 refusing to benchmark stably any higher than 2.8GHz (*We'd tested this chip higher before, but this poor result is within the confines of this comparison*). Nobody outside of Intel knows why most of the 45nm Core 2 Quads don't overclock well, but whatever the reason, you're better off buying an older Q6600 and overclocking it. It may be more than two years old -practically a millennia in the fast-moving PC industry - but the Q6600 is like a classic car that has aged extremely well.

The Q9650 helps to repair the poor overclocking reputation of the 45nm Core 2 Quads. We managed to clock it from its default



of 3GHz to 3.96GHz with a core voltage of 1.45V. This voltage is a lot lower than the voltage we used to overclock the Q6600, as its 45nm transistors are much more sensitive to higher voltages than 65nm transistors. At 3.96GHz, the Q9650 proved to be one of the fastest CPUs, sneaking past the far more expensive Core i7-940. This feat is rendered even greater when you factor in the high price of the triple-channel DDR3 memory and LGA1366 motherboard of the Core i7 CPU. As such, if you want to extend the life of your LGA775 system then upgrading to a Q9650 could be a very good option.

Despite a growing number of games that can take advantage of more than two cores, none of the Core 2 Quads is a sensible purchase for a dedicated gaming rig. That said, we doubt that many Atomics only play games, and the Core 2 Quads really come into their own when multitasking. As long as you're prepared to overclock your new CPU then either the Q6600 or Q9650 would form the basis of a great all-round PC, without burning a Core i7-sized hole in your wallet. ☺



As can be clearly seen in this die shot, a Core 2 Quad consists of two dual-core dies sandwiched together in the same package.

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	Effective FSB	Cache	Price
Core 2 Quad Q6600	LGA775	2.4GHz	3.7GHz	Kentsfield	4 x physical	1,066MHz	2 x L1 = 32KB, 2 x L2 = 4MB	\$360.00
Core 2 Quad Q8200	LGA775	2.33GHz	2.8GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 2MB	\$225.00
Core 2 Quad Q8300	LGA775	2.5GHz	3.3GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 2MB	\$295.00
Core 2 Quad Q9300	LGA775	2.5GHz	3.3GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 3MB	\$389.00
Core 2 Quad Q9450	LGA775	2.66GHz	3.12GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 6MB	\$429.00
Core 2 Quad Q9550	LGA775	2.83GHz	3.3GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 6MB	\$315.00
Core 2 Quad Q9650	LGA775	3GHz	3.96GHz	Yorkfield	4 x physical	1,333MHz	2 x L1 = 32KB, 2 x L2 = 6MB	\$435.00

## AMD Phenom X3

Three strikes ring true

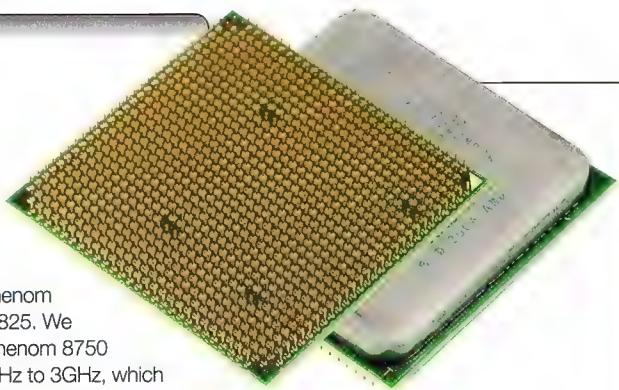
- + Better (just) than Athlon X2s at video encoding
- Poor performance; high power consumption; overpriced

As their name suggests, Phenom X3 CPUs have three cores rather than the usual two or four. All three AM2+ Phenom X3s are based on the 65nm Toliman core and have a TDP of 95W. Cache levels are identical to those of the Phenom X4-series (see p62), with 512KB of Level 2 cache per core and 2MB of shared Level 3 cache.

Despite having three cores, the benchmark results of the Phenom X3s were very poor. For example, the \$108 Athlon X2 7750 Black Edition was faster overall in the Media Benchmarks; its score of 830 trounced the fastest Phenom X3 on test. The \$110 dual-core Intel Pentium E5200 also made a

mockery of the triple-core Phenom X3s, with an overall score of 825. We managed to overclock the Phenom 8750 from its stock speed of 2.4GHz to 3GHz, which boosted its overall score to 949. However, this was only just ahead of the overclocked Athlon X2 7750 Black Edition, which scored 927.

The Athlon X2 7750 Black Edition proved its worth in Crysis too, achieving a minimum frame rate of 22fps. The Phenom X3 8750 couldn't better this, also recording a minimum frame rate of 22fps. Power consumption is a weak point for the Phenom X3s too, with even the cheapest model, the Phenom X3 8450 causing the test PC to draw 190W - more than any of the Athlon



X2's and the same as the Core 2 Quad Q6600, a significantly faster CPU.

The main reason for the Phenom X3s' poor performance is their low clock speed. Given that the Phenom X3s are more expensive and run hot, none of these CPUs is worth buying. AMD's older Athlon X2s or the new Phenom II X3 720 Black Edition (see below) are much better value for money. 

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	HTT	Cache	Price
<b>Phenom X3 8450</b>	Socket AM2+	2.1GHz	2.52GHz	Toliman	3 x physical	200MHz	3 x L1 = 128KB, 3 x L2 = 512KB, L3 = 2MB	\$160.00
<b>Phenom X3 8650</b>	Socket AM2+	2.3GHz	2.75GHz	Toliman	3 x physical	200MHz	3 x L1 = 128KB, 3 x L2 = 512KB, L3 = 2MB	\$120.00
<b>Phenom X3 8750</b>	Socket AM2+	2.4GHz	3GHz	Toliman	3 x physical	200MHz	3 x L1 = 128KB, 3 x L2 = 512KB, L3 = 2MB	\$217.00



Phenom II X3 720

Like the Phenom X3 CPUs, which are cut-down Phenom X4s with one of the four cores disabled, Phenom II X3s are cut-down Phenom II X4s.

The first Phenom II X3 to hit the market is the 720 Black Edition. It's clocked at a respectable 2.8GHz and has 6MB of Level 3 cache, the same specifications as the more expensive Phenom II X4 920, but as it has only three cores, each core receives a slightly higher proportion of cache.

Unlike the most Phenom IIs, the 720 Black Edition is a Socket AM3 processor, so its integrated memory controller supports both DDR2 and DDR3 memory. Socket AM3 is pin-compatible with Socket AM2+, but as none of the motherboards in our lab would POST with the 720 Black Edition installed, we had to test it in a Socket AM3 motherboard with dual-channel DDR3.

Despite having one less core the 720 Black Edition performs significantly better than the more expensive Phenom X4 9750, scoring 980 in our Media Benchmarks compared to 858. It's also much faster in games, providing between an extra 3-7fps. The 720 Black Edition's third core gives it a significant advantage in media encoding

## AMD Phenom II X3

Faster, cooler and more overclockable than Phenom X3

- + Good stock speed performance; easily overclockable
- Core 2 Duo is much faster when overclocked

applications, and it sped past the E7300.

As it's a 45nm CPU, the 720 Black Edition overclocks much better than the Phenom X3. Its CPU multiplier is unlocked, and by raising its vCore to 1.566V, we overclocked it from 2.8GHz to 3.7GHz, boosting its Media Benchmark score to 1,192. While this is a very good overclock, the cheaper E7300 is a stunning overclocker, easily reaching 4.2GHz, at which frequency it pummeled the overclocked 720 Black Edition with its score of 1,433.

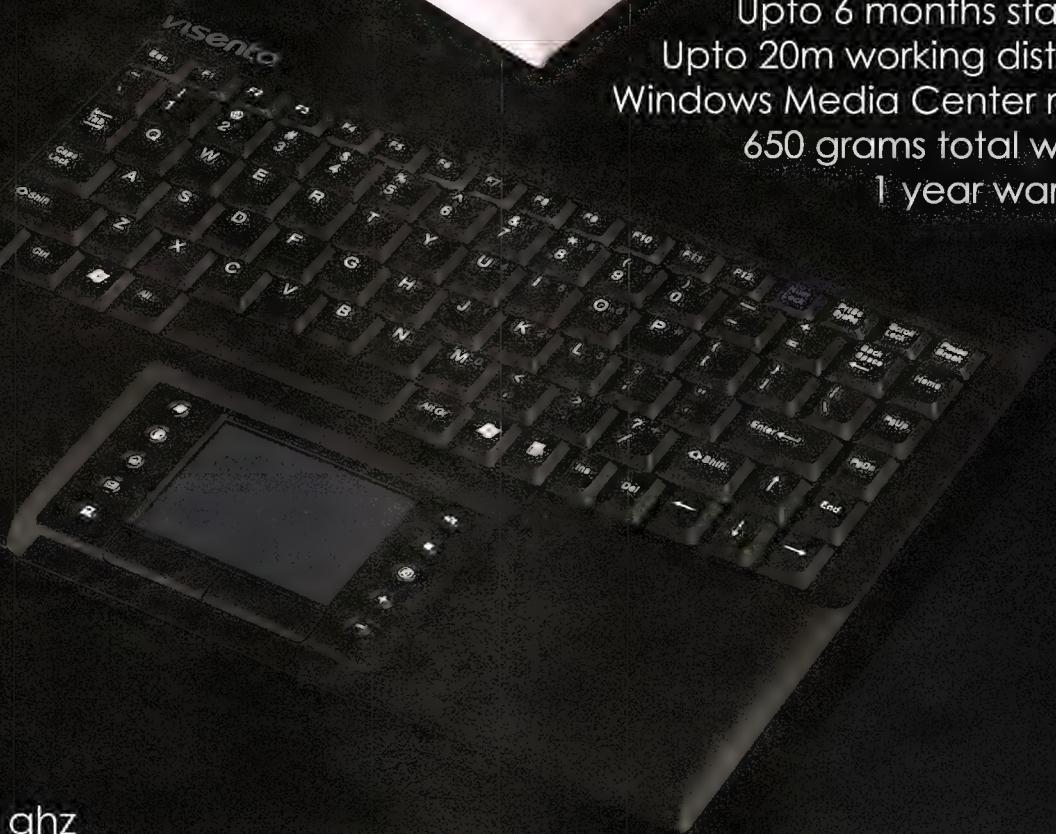
However, thanks to recent aggressive price cuts on the Core 2 Duo E8400 and E8500, these faster, more overclockable, more energy-efficient chips should still be at the top of your list. 

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	HTT	Cache	Price
<b>Phenom X3 II 720 Black Edition</b>	Socket AM3	2.8GHz	3.7GHz	Heka	3 x physical	200MHz	3 x L1 = 128KB, 3 x L2 = 512KB, L3 = 6MB	\$195.00

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## AMD Phenom X4

Slow, power-hungry and toasty warm

 Much faster than Athlon X2s at video encoding

 Massive power draw; poor performance; limited overclockability

Four of AMD's Socket AM2+ Phenom X4 CPUs are represented in this year's CPU Labs test, ranging from the energy-efficient Phenom X4 9350e to the power-hungry Phenom X4 9950 Black Edition. Each Phenom X4 has four 65nm Agena cores, as opposed to the 45nm Deneb cores featured in the Phenom II X4. They also have a three-tier cache system, with each of the four cores sporting 128KB of Level 1 cache, 512KB of Level 2 cache and 2MB of Level 3 cache shared between the four cores. Clock speeds range from 2GHz for the energy-efficient 9350e to 2.6GHz for the multiplier-unlocked 9950 Black Edition.

Despite having four cores, the Phenom X4s aren't particularly fast, with the 9350e recording a score of 1,045 in the video encoding test - significantly slower than the triple-core Phenom II X3 720 Black Edition and all of the Core 2 Duo E8000-series CPUs. Due to their low clock frequency, they also performed very poorly in the image editing and multitasking tests. As a result, their overall scores were poor, so much so that the 9350e is slower than some of AMD's earlier and less expensive dual-core Athlon X2 CPUs.

The lacklustre performance continued in games, with none of the Phenom X4 CPUs able to pull ahead of the Phenom X3 or Athlon X2 CPUs. In Flight Simulator X, the 9950 Black Edition managed a minimum frame rate of 10fps, which was equalled by the significantly cheaper Athlon X2 7750 Black Edition. The latter was also able to keep up in Crysis, with a minimum

frame rate of 22fps, which is the same as the 9950 Black Edition. Matters were even worse at the bottom end of the series, with the Athlon X2 4850e matching the 9350e's minimum of 8fps in Flight Simulator X. This is bad news indeed, considering that the 9350e costs nearly twice as much.

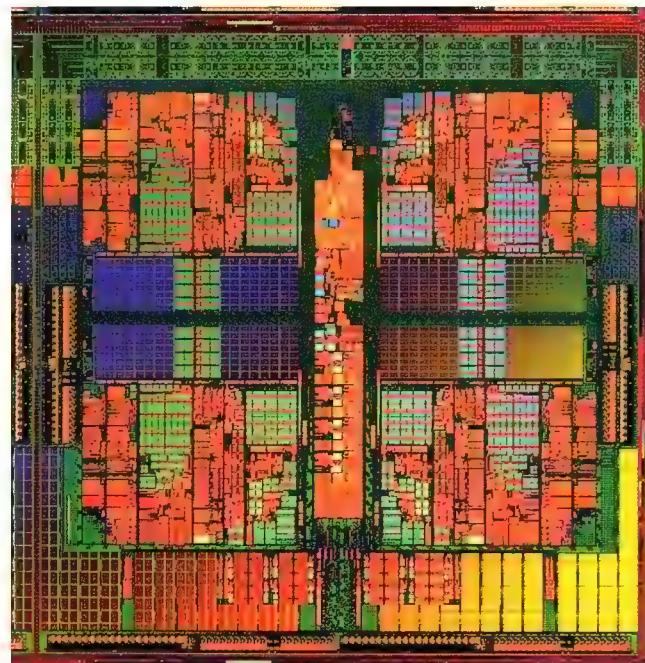
At stock speeds, the Phenom X4s also draw a significant amount of power. The only CPUs that draw this much power are the Core 2 Extreme QX9770 and three Core-i7 CPUs, but these CPUs are vastly superior in terms of performance. The 9350e might appear to live up to the energy-efficient 'e' in its name, but given that its clock speed is considerably lower than any of the other Phenom X4s, the system's

maximum power draw of 173W isn't that low compared with the 9750, which drew 205W but has a 400MHz higher clock speed.

Due to their high power consumption, the Phenom X4s were even less overclockable than the Phenom X3s. The 9950 Black Edition's overall score increased from 907 to 997 when we increased its clock speed to from 2.6GHz to 2.9GHz. The boost in games was equally disappointing, with the minimum frame rate in Flight Simulator X increasing from 10fps to just 12fps, and in Crysis from 22fps to 23fps.

As if the poor overclocking performance isn't bad enough, an overclocked Phenom X4 CPUs draws enough power to light a house. The 9950 Black Edition in particular was as toasty as a slice of Wonder White in the morning, drawing an eye-watering 320W. The 9850 Black Edition is even worse - when overclocked, it has killed the VRMs of seven Socket AM2+ motherboards in the lab over the last few months.

Everything about the Phenom X4s is decidedly cringe-worthy; they draw a huge amount of power, offer poor performance, especially in games, and lack overclocking headroom. If you're upgrading an old Socket AM2 system that's compatible with Socket AM2+, then the Phenom II CPUs are a far better buy. If you're building a new system, though, a Core 2 Duo or Core 2 Quad is superior in every way.



AMD's first quad-core CPUs are simply terrible – in some applications and games, they're slower than the older dual-core Athlon X2s.

CPU	Packaging	Frequency	Maxoverclock	Core	Number of cores	HTT	Cache	Price
Phenom X4 9350e	Socket AM2+	2GHz	2.5GHz	Agena	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 2MB	\$215.00
Phenom X4 9750	Socket AM2+	2.4GHz	2.88GHz	Agena	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 2MB	\$185.00
Phenom X4 9850 Black Edition	Socket AM2+	2.8GHz	2.5GHz	Agena	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 2MB	\$276.00
Phenom X4 9950 Black Edition	Socket AM2+	2.9GHz	2.5GHz	Agena	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 2MB	\$220.00

# AMD Phenom II X4

Cooler, faster and much more overclockable than Phenom X4

 Competitive performance; no cold bug

 Not very good at gaming

Despite its Phenom II branding, this series of processors is AMD's third attempt to get Phenom right. The basic AMD64 architecture remains unchanged, although AMD has made several improvements to the core execution engine.

The single biggest improvement to Phenom II is the change from 65nm to 45nm transistors. As anybody who has followed semiconductor manufacturing process development could tell you, smaller transistors consume and waste less power than larger transistors. High power consumption was the Achilles heel of the original Phenom - it limited the frequency at which AMD could clock them, made them run extremely hot and severely limited overclocking. Due to their smaller transistors, Phenom II's run considerably cooler than the original Phenoms, despite running at a higher frequency.

The smaller manufacturing process also provides more room in the die for additional cache. Each of the four cores has 128KB of Level 1 cache and 512KB of Level 2 cache, but the Level 3 cache shared by all the cores has been at least doubled, and in some models, tripled. AMD estimates the increase in Level 3 cache should yield on average an additional 6 per cent extra performance over a Phenom X4 running at the same frequency.

At the time of writing, AMD had launched three Phenom II X4s. The 940 Black Edition is clocked at 3GHz, and has 6MB of Level 3 cache and the same Socket AM2+ packaging

as the Phenom X3 and X4. As a Black Edition chip has an unlocked CPU multiplier, the CPU can be easily overclocked. The 920 has the same cache configuration and Socket AM2+ packaging, but its CPU multiplier is locked and it's clocked at 2.8GHz. Both of these models support standard DDR2 RAM.

The 920 is priced very similarly to the Core 2 Duo E8500, Core 2 Quad Q6600 and Q8300. Although the 920 is very competitive at heavily multithreaded tasks such as video encoding and 3D rendering, the higher frequency of the E8500 makes it much faster in other applications and games. We managed to overclock the 920 from 2.8GHz to 3.5GHz by raising its vCore to 1.425V, but even then, on average, it was slightly slower than the similarly priced Intel CPUs.

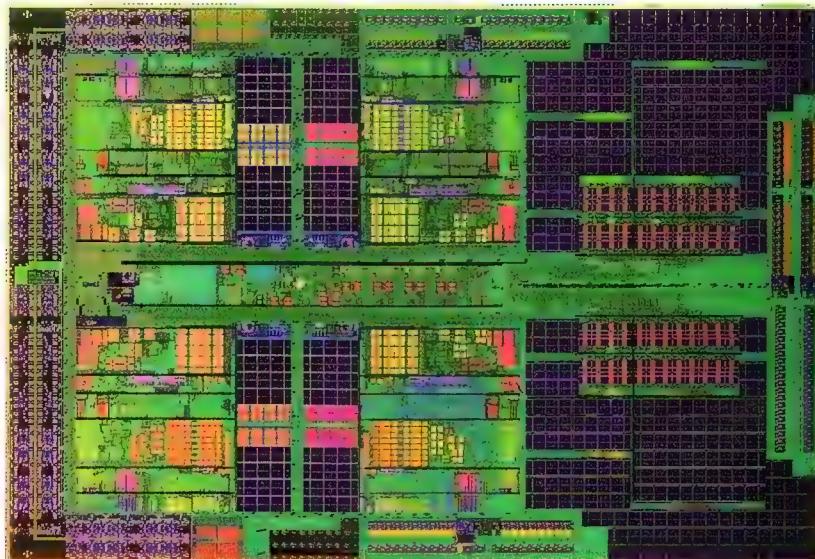
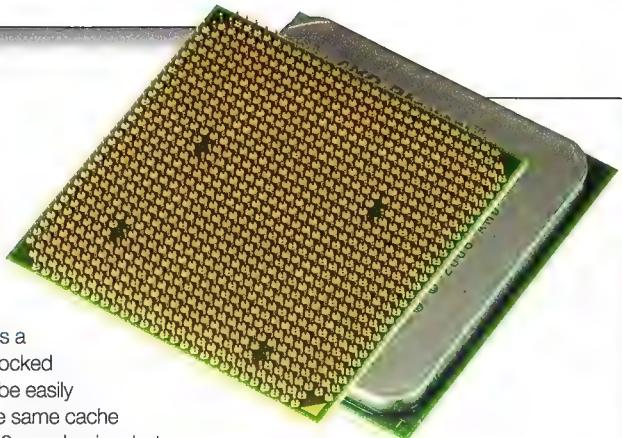
The 940 Black Edition is a close price match to the Core 2 Quad Q9300, and faster in most applications and games. The 940 Black Edition further improved its performance lead when overclocked; thanks to the unlocked CPU

multiplier, we could boost its frequency from 3GHz to 3.6GHz with a vCore of 1.45V. Even when overclocked to 3.3GHz, the Q9300 failed to close the performance gap with the overclocked 940 Black Edition. However, the Q9300 isn't a very competitive Core 2 Quad, and when compared to the Core 2 Duo E8500, the 940 Black Edition, even when overclocked, comes off significantly worse.

AMD has recently added a third chip to the Phenom II X4 series. The 810 is only clocked at 2.6GHz and has a smaller 4MB of Level 3 cache but its integrated memory controller can address DDR2 and DDR3 memory. For this reason it uses the new Socket AM3 package, which although officially pin-compatible with Socket AM2+, we couldn't get to work in any

of the Socket AM2+ motherboards in our lab. For this reason we had to test the 810 in a Socket AM3 motherboard with DDR3 memory.

Ultimately, while the Phenom II X4 series is a massive improvement over Phenom X4, providing extra performance, running cooler, drawing less power and overclocking further, it's only worth buying if you already have a Socket AM2+ motherboard. For everyone else, a similarly priced Core 2 Duo or Core 2 Quad is a better option. 



The new 6MB of Level 3 cache can be seen to the right of this Deneb die-shot, while the four execution cores are situated to the left.

Processor	Packaging	Frequency	Max overclock	Core	Number of cores	HTT	Cache	Price
Phenom II X4 810	Socket AM3	2.6GHz	3.5GHz	Deneb	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 4MB	\$235.00
Phenom II X4 920	Socket AM2+	2.8GHz	3.5GHz	Deneb	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 6MB	\$365.00
Phenom II X4 940 Black Edition	Socket AM2+	3GHz	3.6GHz	Deneb	4 x physical	200MHz	4 x L1 = 128KB, 4 x L2 = 512KB, L3 = 6MB	\$275.00

## Intel Core 2 Extreme

Incredible (expense) and (outstripped) performance

Very fast and overclockable

Extremely poor value for money

The Core 2 Extreme CPUs have in theory been superseded by the Core i7-series they remain some of the fastest processors available. The QX9650 was the world's first 45nm CPU and also marked the introduction of the Penryn architecture.

Both the QX9650 and QX9770 have four cores and the same cache arrangement of 6MB of Level 2 cache shared between each pair of cores. While the QX9650 is clocked at 3GHz and has a 1,333MHz effective FSB, the QX9770 runs at 3.2GHz and has a 1,600MHz-effective FSB. As both models have an unlocked CPU multiplier, they're very easy to overclock.

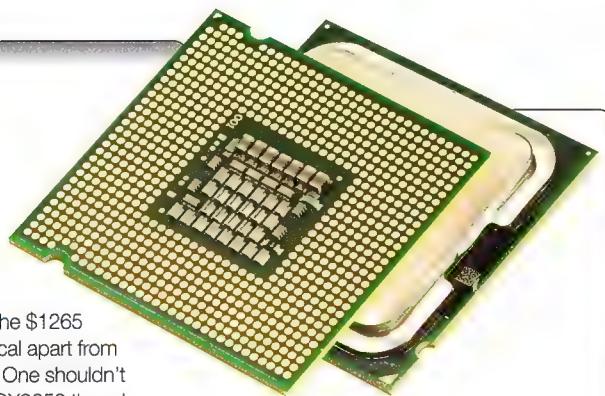
Despite its premium pricing, the QX9650

is matched in performance by the \$1265 cheaper Q9650, which is identical apart from having a locked CPU multiplier. One shouldn't belittle the performance of the QX9650 though - its video encoding score of 1,799 and high frame rates in games are among the highest of any CPU. The QX9770 is only slightly faster, but it's still the fastest LGA775 CPU you can buy.

By increasing its vCore to 1.55V, we could overclock the QX9650 from 3GHz to 3.83GHz, which is a modest improvement, although it's easily beaten by the Q9650, which overclocked to 3.96GHz. As always with overclocking, your mileage may vary, but it isn't uncommon for Q9650s to overclock further than QX9650s, as they're based on a later stepping. In contrast,

with its vCore increased to 1.48V, the QX9770 would happily benchmark at 4.2GHz - the highest frequency at which any quad-core LGA775 would stably run. While the benchmark results at this frequency are very fast, the much cheaper Core i7-940 is faster.

However, neither model is currently worth buying, as a Core i7 is much faster and cheaper, even when you take into account the high price of LGA1366 motherboards and triple-channel DDR3.



CPU	Packaging	Frequency	Max overclock	Core	Number of cores	Effective FSB	Cache	Price
Core 2 Extreme QX9650	LGA775	3GHz	3.83GHz	Yorkfield	4 x physical	1,333MHz	4 x L1 = 32KB, 2 x L2 = 6MB	\$1,700.00
Core 2 Extreme QX9770	LGA775	3.2GHz	4.2GHz	Yorkfield	4 x physical	1,600MHz	4 x L1 = 32KB, 2 x L2 = 6MB	\$2,530.00



## Intel Core 2 Extreme (LGA771)

Woozle wuzzle (you keep trying to come up with these!)

Unmatched performance in certain applications

Ludicrously expensive; poor gaming performance

While an increasing number of games are able to take advantage of four processor cores, outside of the professional video production and 3D animation/rendering industry, there are very few applications that can take advantage of eight CPU cores.

However, this didn't prevent Intel from producing Skultrail, an octo-core gaming platform. With support for both CrossFire and SLI, plus the ability to overclock two quad-core CPUs, the theory behind Skultrail was that rather than users having a separate octo-core system for work and another dual- or quad-core PC for gaming, you could

use a single all-powerful PC for both. The end result was a partnership between two products, the Intel D5400XS motherboard and a pair of LGA771 Core 2 Extreme QX9775 CPUs.

While it uses the same LGA771 packaging as the Xeon C2Ds, its pre-fetchers are optimised for consumer applications and games, rather than workstation and server applications.

Due to its high frequency CPUs, a Skultrail system tears through most benchmarks, even though very few consumer applications can take advantage of all eight cores. Although you can install up to four graphics cards in the D5400XS, its use of slow FBDIMM memory means that it's outperformed by the QX9770, high-end Core 2 Duos and Core i7s in games.

By raising the vCore of both CPUs to 1.5V, we managed to overclock them from 3.2GHz to 4.2GHz. This significantly boosted the system's performance in most benchmarks, resulting in a record-breaking score of 26,099 in Cinebench. However, Flight Simulator X refused to budge above a dire 10fps, even when overclocked - clearly this game doesn't like Skultrail at all.

While the pair of QX9775s retain their crown in heavily multithreaded tasks such as 3D rendering, with the advent of the Core i7-series, the CPU is no longer a good purchase, even if you have money to burn. Hardcore gamers would be better off buying a far cheaper Core 2 Duo or Core i7.

CPU	Packaging	Frequency	Max overclock	Core	Number of cores	Effective FSB	Cache	Price
Core 2 Extreme QX9775	LGA771	3.2GHz	4.2GHz	Yorkfield	4 x physical (each)	1,600MHz	4 x L1 = 32KB, 2 x L2 = 6MB	\$2,601.00

# Intel Core i7

The fastest single-socket processors to date

- + Incredible performance; great overclockers
- X58 motherboards and DDR3 are very expensive

Despite the lack of serious competition from AMD as 2008 drew to a close, Intel pushed ahead and released the Core i7 series of processors based on the new Nehalem architecture.

Although Nehalem shares many features with the earlier Penryn architecture used in Core 2 CPUs it's a pretty radical departure from earlier Intel CPUs. Unlike AMD, which has made CPUs with an integrated memory controller for many years, the Core i7 series was Intel's first CPU with an integrated memory controller. The main advantage of an integrated memory controller is reduced latency, but Core i7 CPUs also benefit from support for triple-channel DDR3, which provides a huge amount of bandwidth.

Intel also upgraded many of the core architectural features, such as macrofusion, the process by which multiple simple instructions are combined into a single micro-op so that the decoder can process more work in the same amount of time (it can only address a one micro-op at a time). Improvements were also made to the loop stream detector, branch predictor and reservation station. This technology allows each of the four cores to process a second thread when any spare resources are available. On paper, this means that a Core i7 CPU can process eight threads simultaneously, but in the real world, you're unlikely to see more than a 15 per cent performance increase, even in the most heavily multithreaded applications.

Due to their integrated memory controller, Core i7 CPUs use LGA1366 packaging, which isn't compatible with Core 2's LGA775. As a result, you're forced to buy an LGA1366 motherboard based on the Intel X58 chipset. While

many of these are fantastic overclockers and have numerous great features, they're very expensive, costing around twice as much as a high-end LGA775 motherboard.

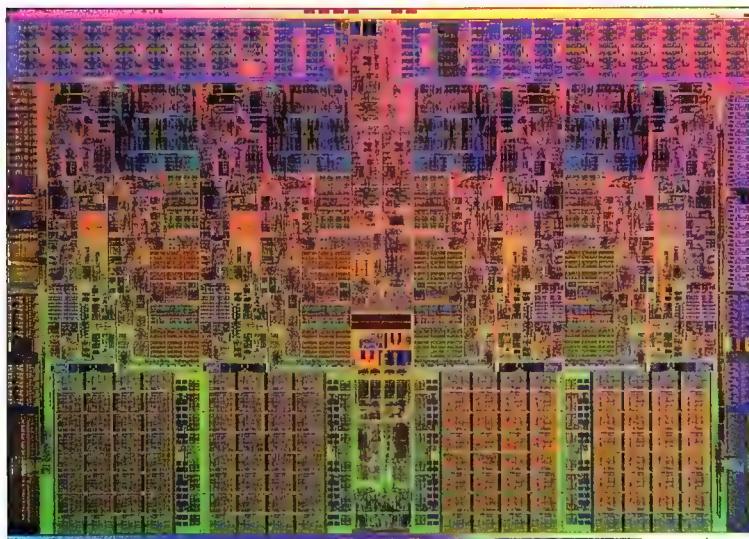
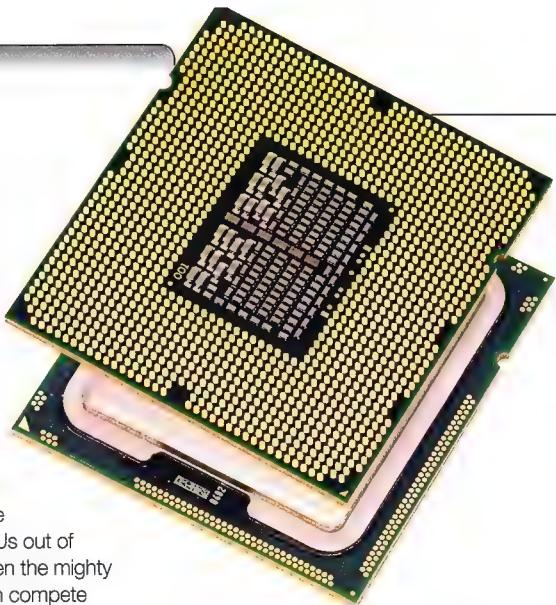
If you run lots of multithreaded applications or multitask a lot, the i7-920 blows all non-Core i7 CPUs out of the water. No other CPU, not even the mighty (and quite ludicrous) Skulltrail can compete with the i7-920. The i7-940 is also brilliant at gaming, although the high-end models of the Core 2 Duo E8000-series (see p57) are faster due to their very high frequency. The i7-940 and i7-965 Extreme Edition are faster still, the latter racking up the fastest results in nine of the 12 benchmarks we ran on all the processors, despite not being the most expensive CPU.

All three Core i7s are also brilliant overclockers, although there isn't a huge difference in the maximum frequency each model can reach when air-cooled. By increasing the vCore of each model to 1.485V, we successfully overclocked the i7-920 to 4GHz, the i7-940 to

4.02GHz and the i7-965 Extreme Edition to 4.14GHz. As no other CPU series can touch the Core i7s when running at their stock frequencies, once overclocked, the Core i7s can only be described as incredibly fast. The only CPUs able to keep up was the pair of overclocked Core 2 Extreme QX9775s in the Skulltrail rig, but that was only in the synthetic WPrime benchmark and 3D rendering test Cinebench.

With AMD struggling to escape from the spectre of the appalling first- and second-generation Phenoms, Core i7 only has to compete with Core 2.

Although Core i7 CPUs are reasonably priced considering their incredible performance, the high price of X58 motherboards and triple-channel DDR3 makes the entire system cost considerably higher. With that in mind, given the superior performance of the high-end Core 2 Duo E8000-series in games, an E8600 or an overclocked Core 2 Quad Q6600 or Q9650 is a more sensible choice for most readers. However, if you do more than play games on your PC, or just want the very best, there's no denying the awesome power of Core i7. 



A close-up of the die of a Nehalem CPU in all its glory.

CPU	Packaging	Frequency	Maxoverclock	Core	Number of cores	Effective QPI	Cache	Price
Core i7-920	LGA1366	2.66GHz	4GHz	Bloomfield	4 x physical, 4 x logical	1,333MHz	4 x L1 = 64KB, 4 x L2 = 256KB, L3 = 8MB	\$395.00
Core i7-940	LGA1366	2.93GHz	4.02GHz	Bloomfield	4 x physical, 4 x logical	1,333MHz	4 x L1 = 64KB, 4 x L2 = 256KB, L3 = 8MB	\$900.00
Core i7-965 Extreme Edition	LGA1366	3.2GHz	4.14GHz	Bloomfield	4 x physical, 4 x logical	1,333MHz	4 x L1 = 64KB, 4 x L2 = 256KB, L3 = 8MB	\$1,750.00

Standard

Overclocked

Minimum

Average

**Overall media results**

Intel Core i7-965 Extreme Edition	1704	2056
Intel Core i7-940	1594	2040
Intel Core i7-920	1431	2030
Intel Core 2 Extreme QX9775	1426	1710
Intel Core 2 Extreme QX9770	1382	1694
Intel Core 2 Extreme QX9650	1334	1570
Intel Core 2 Quad Q9650	1307	1630
Intel Core 2 Quad Q9550	1230	1383
Intel Core 2 Duo E8600	1180	1515
Intel Core 2 Quad Q9450	1174	1334
AMD Phenom II X4 940 Black Edition	1157	1374
Intel Core 2 Duo E8500	1140	1482
Intel Core 2 Duo E8400	1071	1477
AMD Phenom II X4 920	1066	1314
Intel Core 2 Quad Q8600	1056	1309
Intel Core 2 Quad Q9300	1047	1336
Intel Core 2 Quad Q6600	1028	1420
Intel Core 2 Quad Q8200	995	1116
AMD Phenom II X4 810	994	1260
AMD Phenom II X3 720 Black Edition	980	1193
AMD Phenon X4 9950 Black Edition	907	997
Intel Core 2 Duo E7300	900	1433
AMD Phenon X4 9850 Black Edition	897	
AMD Phenon X4 9750	858	1018
AMD Athlon X2 7750 Black Edition	830	927
Intel Pentium E5200	825	1208
AMD Phenom X3 8750	815	951
AMD Phenom X3 8750 Black Edition	813	949
AMD Athlon X2 6000+	801	883
AMD Phenom X3 8650	778	906
AMD Phenon X4 9350e	775	912
AMD Athlon X2 5600+	757	825
AMD Athlon X2 5400+	738	835
AMD Phenom X3 8450	724	876
Intel Pentium E2200	718	1028
AMD Athlon X2 5050e	693	780
Intel Pentium E2200	677	1012
AMD Athlon X2 4850e	673	775
Intel Pentium E2180	644	997
Intel Celeron E1400	581	957
Intel Celeron E1200	491	833

**Crysis 1280x1024, 2xAA**

Intel Core i7-940	35	46
Intel Core i7-965 Extreme Edition	36	46
Intel Core 2 Duo E8400	35	44
Intel Core 2 Duo E8500	35	44
Intel Core 2 Duo E8600	35	44
Intel Core 2 Extreme QX9770	35	45
Intel Core 2 Quad Q9550	35	44
Intel Core 2 Quad Q9650	35	45
Intel Core 2 Extreme QX9650	34	44
Intel Core 2 Quad Q9450	31	41
Intel Core i7-920	31	41
AMD Phenom II X4 940 Black Edition	29	37
Intel Core 2 Quad Q8300	29	38
Intel Core 2 Extreme QX9775	28	38
Intel Core 2 Quad Q9300	28	37
Intel Core 2 Duo E7300	27	35
AMD Phenom II X3 720 Black Edition	24	34
Intel Core 2 Quad Q6600	24	35
Intel Core 2 Quad Q8200	24	35
AMD Phenom II X4 810	23	31
AMD Athlon X2 6000+	22	27
AMD Athlon X2 7750 Black Edition	22	31
AMD Phenom II X4 920	22	31
AMD Phenom X38750	22	28
AMD Phenom X38750 Black Edition	22	28
AMD Phenom X4 9950 Black Edition	22	32
Intel Pentium E5200	22	31
AMD Phenom X4 9850 Black Edition	21	31
AMD Phenon X49750	20	30
AMD Athlon X2 5400+	19	26
AMD Athlon X2 5600+	19	26
Intel Pentium E2220	19	26
AMD Athlon X2 5050e	18	23
AMD Phenom X3 8450	18	26
AMD Phenom X3 8650	18	27
AMD Athlon X2 4850e	17	23
Intel Pentium E2200	17	24
AMD Phenon X4 9350e	16	25
Intel Pentium E2180	16	23
Intel Celeron E1400	13	17
Intel Celeron E1200	11	16

Minimum   Average

### Flight Simulator X 1280x1024

Intel Core 2 Duo E8600	18	28
Intel Core i7-965 Extreme Edition	18	26
Intel Core 2 Duo E8500	17	26
Intel Core 2 Duo E7300	16	23
Intel Core 2 Extreme QX9650	16	26
Intel Core 2 Extreme QX9770	16	27
Intel Core 2 Quad Q9650	16	25
Intel Core i7-940	16	24
Intel Core 2 Duo E8400	15	26
AMD Phenom II X3 720 Black Edition	13	22
AMD Phenom II X4 940 Black Edition	13	23
Intel Core 2 Quad Q9550	13	24
AMD Phenom II X4 810	12	22
AMD Phenom II X4 920	12	22
Intel Core 2 Quad Q6600	12	20
Intel Core 2 Quad Q8200	12	20
Intel Core 2 Quad Q8300	12	22
Intel Core 2 Quad Q9300	12	22
Intel Core 2 Quad Q9450	12	24
Intel Core i7-920	12	24
Intel Pentium E5200	12	20
Intel Pentium E2220	11	19
AMD Athlon X2 7750 Black Edition	10	18
AMD Phenom X38750	10	16
AMD Phenom X38750 Black Edition	10	16
AMD Phenom X4 49750	10	16
AMD Phenom X4 9850 Black Edition	10	17
AMD Phenom X4 9950 Black Edition	10	17
Intel Core 2 Extreme QX9775	10	15
Intel Pentium E2180	10	19
Intel Pentium E2200	10	19
AMD Athlon X2 5050e	9	15
AMD Athlon X2 5400+	9	15
AMD Athlon X2 5600+	9	16
AMD Athlon X2 6000+	9	17
AMD Phenom X3 8650	9	15
AMD Athlon X2 4850e	8	14
AMD Phenom X3 8450	8	14
AMD Phenom X4 8450	8	18
AMD Phenom X4 9350e	7	11
Intel Celeron E1200	7	14

Minimum   Average

### X-3 Terran Conflict

Intel Core 2 Duo E8600	43	90
Intel Core i7-965 Extreme Edition	43	90
Intel Core 2 Duo E8500	42	87
Intel Core 2 Extreme QX9770	38	85
Intel Core 2 Duo E8400	37	79
Intel Core 2 Extreme QX9650	37	81
Intel Core 2 Quad Q9650	37	80
Intel Core i7-920	37	81
Intel Core 2 Quad Q9550	36	78
AMD Phenom II X3 720 Black Edition	33	71
AMD Phenom II X4 940 Black Edition	33	71
AMD Phenom II X4 920	32	69
Intel Core 2 Duo E7300	32	68
Intel Core 2 Extreme QX9775	32	72
Intel Core 2 Quad Q9450	31	71
AMD Phenom II X4 810	30	65
Intel Core 2 Quad Q8300	30	65
Intel Core 2 Quad Q6600	29	63
Intel Core 2 Quad Q9300	28	63
AMD Phenom X4 9950 Black Edition	27	58
Intel Core 2 Quad Q8200	27	61
Intel Pentium E5200	27	63
AMD Athlon X2 7750 Black Edition	26	56
AMD Phenom X4 9850 Black Edition	26	57
AMD Athlon X2 6000+	25	55
AMD Phenom X3 8750	25	54
AMD Phenom X38750 Black Edition	25	54
AMD Phenom X49750	25	55
AMD Phenom X3 8650	24	53
AMD Athlon X2 5600+	23	51
Intel Pentium E2220	23	50
AMD Athlon X2 5400+	22	49
AMD Phenom X3 8450	22	49
AMD Phenom X4 9350e	22	49
AMD Athlon X2 4850e	21	45
AMD Athlon X2 5050e	21	47
Intel Pentium E2200	20	45
Intel Pentium E2180	19	45
Intel Celeron E1400	13	34
Intel Celeron E1200	12	29



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```

float:left;
cursor:pointer;
cursor:hand;
background-position:0px -14px;

```

# Nerd Skill Number One

**Daniel Rutter** looks back at the command line.

**C**ommand-line interfaces, where you control software only by typing, used to be the Universal Symbol of Computer Expertise. And fair enough, because I think the command-line's got a lot of life in it yet. Only Star Trek voice control could really supplant it.

This is partly because nobody's yet figured out a better way to send some complex commands for things like database, 3D rendering and scientific computation applications.

And at the other end of the complexity scale, it's just plain hard to make any user interface beyond a basic command-line.

Okay, all right, it's actually quite easy to make a graphical interface for even very complex software. If you don't spend a lot of time on getting that interface right, though, it's likely to be a hideous disaster ([www.dansdata.com/gz073.htm](http://www.dansdata.com/gz073.htm)). A command-line interface,

Google users don't even know about putting phrases in quotes, but a small amount of help-page research really pays off.

A lot of old command-line software, especially on un-networked home computers, had high program-control complexity but worked on very restricted data sets. Google is the other way around; there aren't that many special options, but the data-set is gigantic. This leads to interesting new tricks that previously only interested database wranglers.

Like, suppose you're looking up some fairly obscure subject, and the 'best' page Google finds for you is a small, badly-written Wikipedia article with no references. The PageRank-zero personal site with the answer to your question is out there somewhere, but it'll be pushed well off the first results page by umpteen copies of that Wikipedia article on podunk 'encyclopedia'

there's a good chance that it doesn't exist anywhere on the Web.

(I just tried this with "needs to have about six words"; zero hits. "Doesn't exist anywhere on the Web" exists in many places on the Web, though!)

The remarkable specificity of surprisingly short strings explains why another modern incarnation of the command-line, whole-system search, works. You usually only have to feed a few characters to Apple's Spotlight or Microsoft's 'Copy Of Spotlight' for them to give you a very short list containing the program or folder you're after.

Command-line computing is more than fifty years old now. So if you're there when a time-travelling computer expert arrives from 1957, just point him to YubNub.

He'll feel right at home.

Dan Rutter runs his own command line, but you don't want to know what he outputs to.  
[dan@atomicmpc.com.au](mailto:dan@atomicmpc.com.au)

## This is connected to an interesting and immensely useful property of human language...

in contrast, can require pretty much no development time at all. And it may scare off casual users and be a pain until you learn the options and switches, but at least, then, it'll work. An awful GUI is awful for everyone, forever.

Many kinds of software are fundamentally incompatible with command-line control. People wouldn't queue up to buy command-line Grand Theft Auto. But a lot of very complex, modern software still talks in simple words and numbers. Knowing how to speak that language properly remains a useful skill, provided you keep up with recent dialects.

The obvious example of a ubiquitous modern command-line interface is Google. It's got a decent suite of basic logical operators, numeric-range values and unit conversions, and an ever-growing collection of other oddities. Many

sites that take advantage of Wikipedia's generous licensing terms.

To avoid seeing all those, you need only add `-[some string from the Wikipedia article]` to your Google search. Usually, it only takes one minusded phrase to clear sufficient copies.

This is connected to an interesting and immensely useful property of human language, which is that the combinatorial explosion of possible grammatical sentences (as opposed to random strings of words) means that most sentences of only six words are likely to be unique.

Try this yourself: Take some six-word sentence, or even piece of another sentence, which you've spoken or written today, and plug it into Google as a quoted phrase search. If your phrase wasn't a quotation, cliché or concise reference to some very common concept,

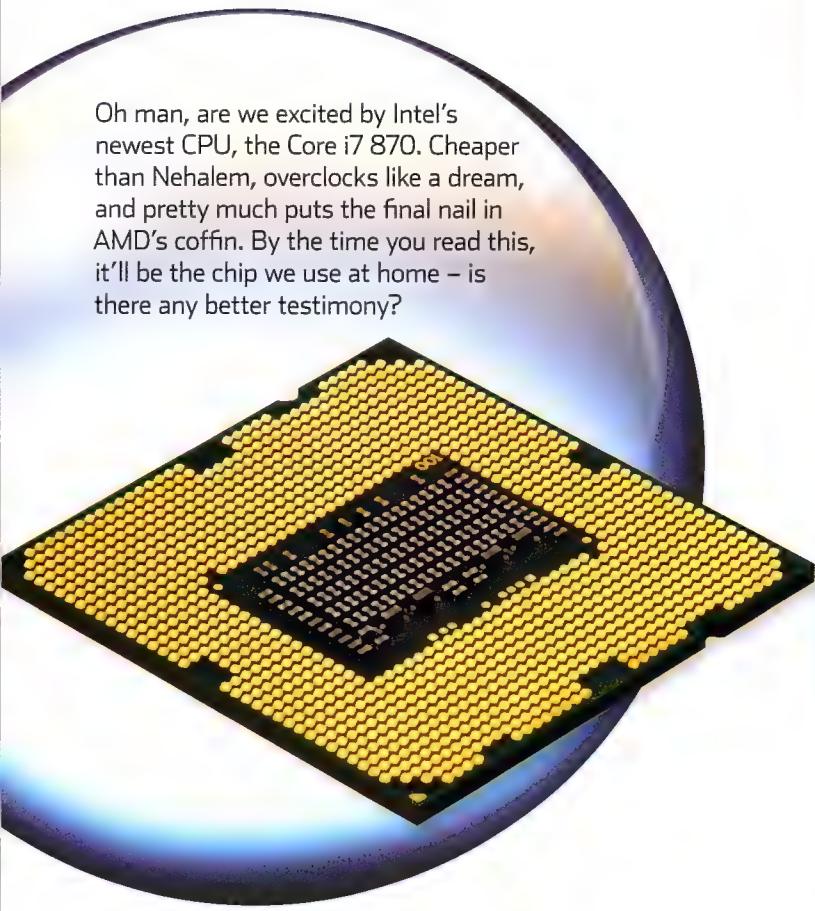


# KITLOG

These are our four basic systems, with something for every taste. On this page, the **Basic Game Box** is put together with money-saving in mind, but also an eye to getting as much bang for buck. **The Perfect PC**, on the other hand, is the system everyone aspires to, with nothing but the best parts – without going crazy, though.

Over the page, we've got a couple of more focused builds. First, is the **LAN Box**, the ultimate in portable gaming power – go anywhere, frag

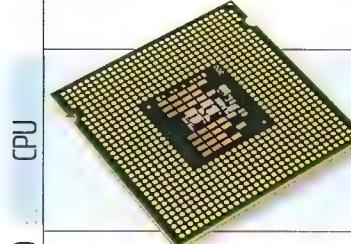
Oh man, are we excited by Intel's newest CPU, the Core i7 870. Cheaper than Nehalem, overclocks like a dream, and pretty much puts the final nail in AMD's coffin. By the time you read this, it'll be the chip we use at home – is there any better testimony?



anyone. Finally, for the more entertainment-minded – and really, that's all of us – there's our **Home Theatre PC**, ready to play movies and music quietly and efficiently.

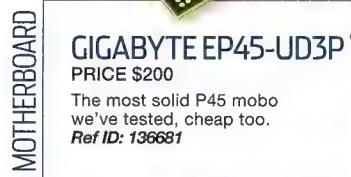
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## BASIC GAME BOX



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*Issue 103, Page 36*



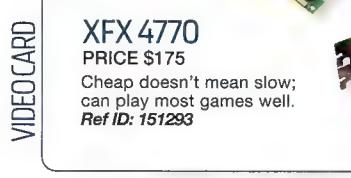
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The most solid P45 mobo we've tested, cheap too.  
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PRICE \$109  
Fast, tweakable and not too expensive.  
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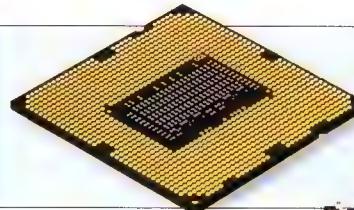


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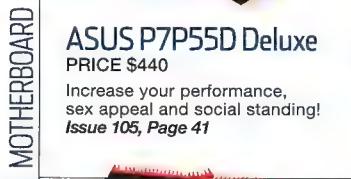


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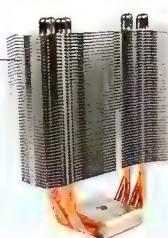
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*Issue 104, Page 36*



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*Issue 103, Page 47*

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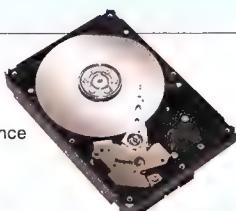
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*Issue 101, Page 41*

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*Issue 105, Page 34*

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*Issue 103, Page 45*

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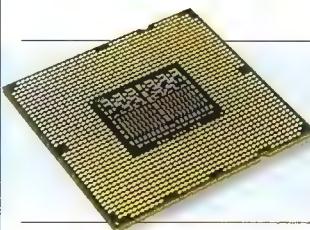
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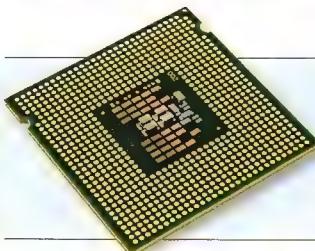


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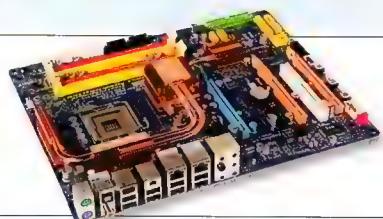
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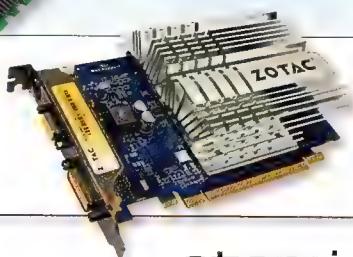
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## SYSTEM DRIVE


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A cool-looking keyboard that'll serve you very well.  
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## DISPLAY

**Verbatim Rapier VI**

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Great gaming performance and nifty features.  
*Issue 96, Page 43*



## KEYBOARD

**Plantronics Gamecom 777**  
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*Issue 101, Page 41*


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## AUDIO

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*Issue 103, Page 47*

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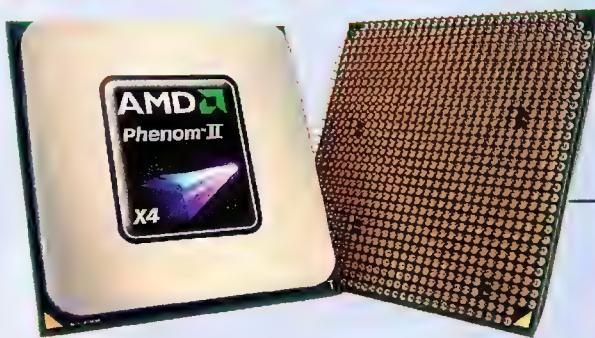
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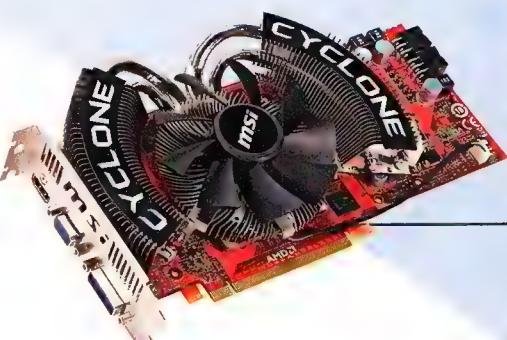
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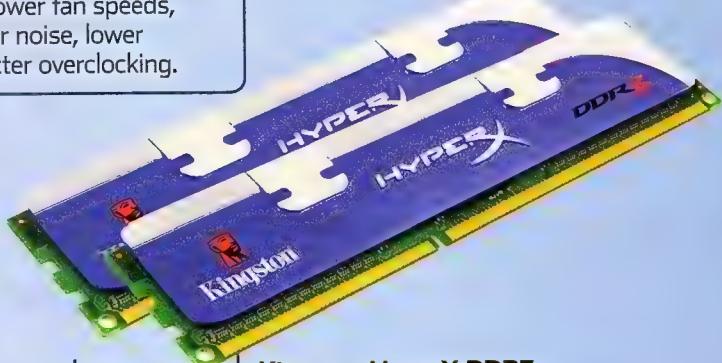
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# TUTORIAL

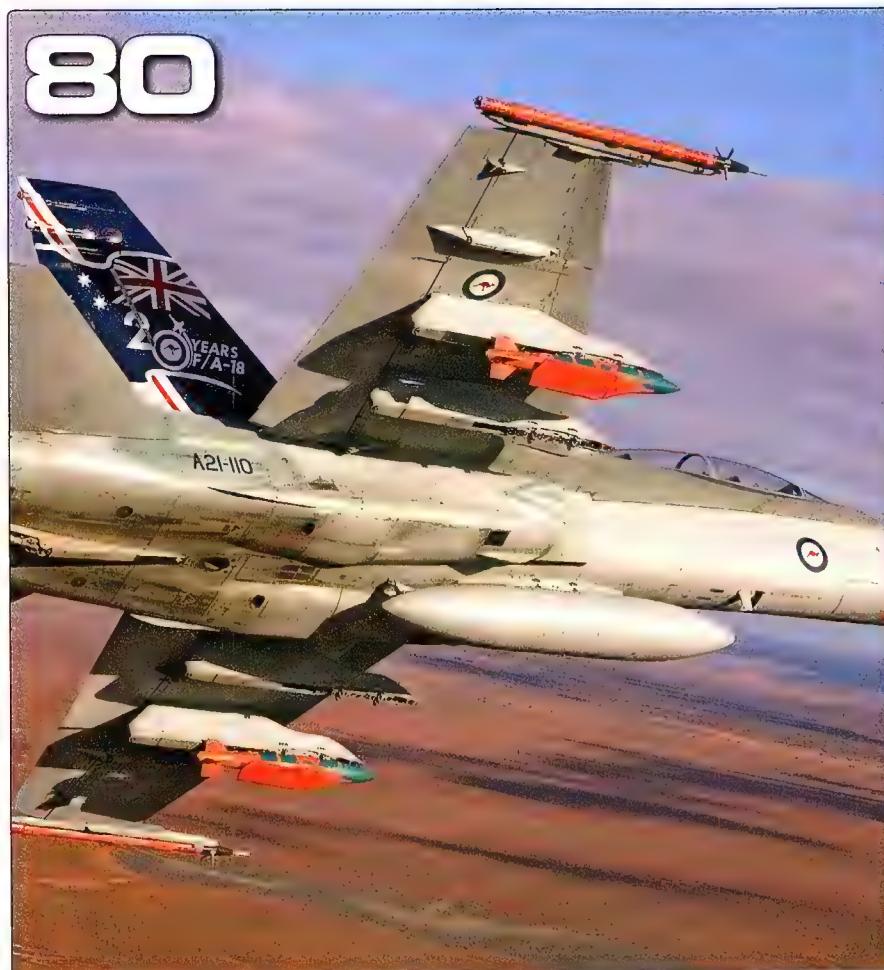
HANDS-ON TUTORIALS FOR THE TECHNICALLY MINDED

**W**e're taking the small-but-perfectly-formed tack this month with our tutes.

Firstly, we've got a treat for fans of watercooling. If you're serious about keeping your CPU cool, you don't use a pre-built kit – you buy the right parts for the job. But upgrades – and new socket formats, can mean serious trouble (and expense). No longer, with our handy guide

to re-suing old waterblocks!

From there, we kick back into the issue's military theme, with a look at what a career in the Army, Navy or Airforce can offer in terms of tech qualifications. There's a lot to like about learning while defending the country, but a lot to be aware of, too. We walk you through what you need to know before you join up.



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Reusing Old Waterblocks	78
Our step-by-step guide to making a new retainer to fit your old waterblock.	
Atomic.edu	80
Join the military, see the world, learn an IT trade.	



## Get some mil-spec tech of your own!

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# Reuse your old waterblock

**Josh Blodwell** explains how to make a new mounting for an old waterblock.

Water-cooling kit is expensive and, unlike other hardware in your PC, it isn't based on technology that evolves rapidly. Manufacturers refine their designs over time, but you don't often see great leaps in performance as you did, say, with the move from Core 2 Duo to Core i7.

While a good CPU and GPU waterblock is worth holding on to, they're often designed for specific hardware, so you may need to replace it when you upgrade your motherboard or graphics card. If you're lucky, you'll be able to buy a new clamp for a few pounds, but for some blocks this won't be an option, or the manufacturer may charge a fortune for it. If so, you can always make your own.

Making your own retention mechanism is surprisingly easy; it doesn't require special tools and the materials are cheap. If you take your time and make accurate measurements, you'll have a clamp that's as effective as the original.

## Copying the design

Perhaps the most obvious approach to making a new clamp for an existing waterblock is to copy the original one and adapt it to fit a new motherboard layout. In a few cases, this is by far the best method – for example, the old D-Tek White Water blocks use a clamp that sits between the waterblock and motherboard. This setup is very simple and can be copied directly with a new sheet of metal. Simply move the motherboard mounting points.



**2** Making sure you get the mounting measurements correct is important.

In other cases – for example, if your block uses an old Socket 939 mount – a basic copy may not be possible. In this situation, the best plan is to make a simple pressure-clamping mount.

This is the simplest type of mounting you can make. Essentially, you'll cut a flat plate to match the top of the waterblock and then attach it to the motherboard with four long screws. You can then carefully tighten the screws to apply even pressure to the block. Although both the design and method are very simple, this allows you to apply as much mounting pressure as you like to the waterblock.

## New screws

If you're lucky, you'll be able to use the nuts and bolts from your previous mount. However, if it came without any, or you've misplaced them,



**4** Leave yourself enough space between the bolt holes and the edge of the clamp plate.

you'll have to find a new set.

Fortunately, you don't need special screws or other equipment to clamp a waterblock to a CPU. You just need four steel bolts; M3 bolts are best as they fit the motherboard mount holes perfectly. Don't use anything larger than M3 or you'll need to drill out the motherboard, which won't end well.

Your four bolts should be at least 30mm long. If you want to use springs to balance the mounting pressure between the bolts, you'll need 40–60mm bolts, depending on the springs and the height of your block. It's best to buy longer bolts and cut them down to the size you need.

You'll also need eight M3 nuts and at least eight plastic washers. Four of the nuts attach the bolts securely to the motherboard, and the eight plastic washers protect the motherboard from scratches and short circuits. If you can't find plastic washers,



**1** Putting masking tape on the bottom of the block will protect it while it's in the workshop.



**3** Measure the waterblock as accurately as you can so that your finished clamp fits perfectly.



**5** Checking your markings and measurements against the block is a good idea, but don't scratch it.



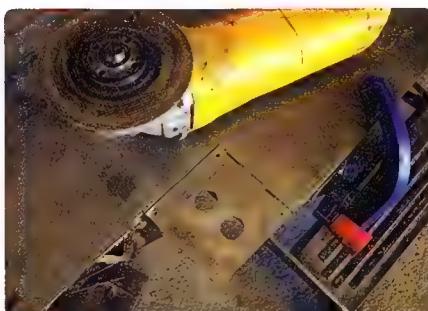
**6** Using a centre punch will help you to drill your holes cleanly and precisely.



**9** As you file away the waste metal, continually check the fit. You don't want to file away too much.



**7** Our simple clamp plate is marked off on the steel sheet and ready to cut out.



**10** Once you're satisfied that the clamp is correct, cut it from the plate.



**8** Working the metal before you cut it from the plate makes the job a lot easier.

you can make your own out of a thick plastic, such as yoghurt pots or other food or drink containers. Just push a hot bolt through to make the central hole and cut out the washer with a pair of scissors.

The other four nuts push down against the clamping plate. If you want to use springs to balance the compression, you need to fit large washers at each end of the spring to prevent the spring from sticking and digging into the clamping plate or popping over the nut.

## Making a Backing Plate

Depending on how your waterblock's original clamping system worked, you may wish to make a backing plate. These are designed to spread the pressure from the mounting holes, and support the motherboard behind the CPU socket. They stop the board bowing, but they also make physical contact with the motherboard, which means you need to be careful not to cause a short circuit.

When cooler manufacturers make backing plates they usually put a sheet of foam or plastic between the plate and the motherboard. This is

essential, as it stops the tiny resistors on the back of the board being crushed or short-circuited. If you decide to copy this part of the design, it's essential that you use some insulation or padding to protect the motherboard or you'll destroy your board, your CPU and who knows what else.

As long as you take precautions to prevent this damage, there's no reason not to use a backing plate. However, the support it provides is limited, and you may find it difficult to sandwich your homemade backing plate between the motherboard and the case.

If you can't get it to fit, ditch the entire plate assembly and use the simpler method of bolts and plastic washers. Under no circumstances should you install the backing plate without insulation.

The most important part of making your clamping plate is obtaining the correct material. The best candidate is a small off-cut of sheet steel. Ideally you want a plate that's 2 or 3mm thick. Anything thicker will be harder to work with and won't provide any additional benefit. Don't use anything thinner than 2mm as your plate may bend under pressure and lose its clamping force.

To make your plate, you need a small selection of tools. A drill with a 3 or 4mm bit and a metal cutting saw are essential. Other tools that you may find useful are a scribe, a square and a metal rule to mark out your pattern, a centre punch to ensure you drill your holes in the correct position, a file to smooth the edges and a sanding and polishing kit to shine up your finished pieces.

You need to take three sets of measurements, and they must all be as close to exact as you can possibly manage. First, measure how far apart the mounting holes on your motherboard are. This will define the size of the clamping plate. Take the distance between all four and add 10mm to the vertical and horizontal measurements. This is the

size of the plate you need. Inscribe these dimensions into your plate, making sure the corners are all 90 degrees. Then mark out lines that are 5mm in from each edge, centre punch the intersections and drill all four out with a 3mm drill.

Next, measure the dimensions of your waterblock. This can be tricky if it's not a simple rectangular shape. What's most important is that the centre of the waterblock lines up with the centre of the clamping plate. For a regular shape, the best way to do this is to measure the block and then scribe the dimensions on to the plate. For more complex shapes, you need to place the block down and trace around it. This gives you an idea of how the block will sit under the clamping plate.

The final measurements you need to make are those of the inlet and outlet pipes, and any irregularities in the block's surface, such as screw heads. This is the most important part of the process, and it's here that you'll have to use some ingenuity in designing your clamp.

## Machining the plate

You need to have as much of the clamping plate lying over the block as possible – in other words, aim to cut away as little material as you can. The plate must also be symmetrical. If there is a cut-out on one side of the plate to allow a hose to pass through, there must be a similar cut-out on the other side to balance the pressure across the plate. That said, if you're using a very thick mounting plate – say 3mm or thicker – or you're clamping a very wide block, this is less important.

With all the shapes marked you can start to cut out the material on the inside of the plate. Roughly cut out the required shape and use a file to fine-tune the cut-outs. Keep checking your cuts against the block, remembering to protect the bottom of the block from being scratched.

Pay particular attention to situating the block centrally under the plate and leaving as much material across the top of the block as you can. When you're satisfied with the fit, cut round the outline of the plate and remove the finished piece.

If you wish, you can polish the steel with sandpaper or a flap disk and spray it with a clear lacquer. Then simply install it in your PC and clamp it down carefully, making sure the block remains in the centre of the clamp until pressure has been evenly applied.



**11** If you were careful with your measurements and cutting, the clamp should line up with the motherboard's mounting holes and the waterblock precisely.

# Careers in the Australian Defence Force



## Chris Taylor wants you!

**S**eeing as we're running a big feature on military technology this month, we figure it's only fitting that this issue's atomic.edu focuses on the Australian Defence Force. The three branches of the Australian Defence Force – the Air Force, Army and Navy – offer numerous jobs in which technology plays a large role. Keep in mind, that if you're to go down this path you'll always be a soldier first and will be entering into an agreement that explicitly states that at any point during your service, the Australian Defence Force could call on you to move, work and fight anywhere in Australia or overseas.

## Requirements and expectations

Whether you want to be an Army cook or an Air Force Communication and Information Systems Controller, you need to meet some basic requirements before you can apply to join the Australian Defence Force.

Firstly, there are physical fitness requirements. For the Navy, the only requirement is to reach

6.1 on a shuttle run (also known as a beep test). For the Army, men need to be able to complete 15 push-ups, 45 sit-ups and get 7.5 on a shuttle run. Women need to be able to complete eight push-ups, 45 sit-ups and get 7.5 on a shuttle run. The Air Force's minimum standards are similar to those of the Navy, although you have to get 6.5 on the shuttle run. If you're seriously contemplating joining the Australian Defence Force but are worried about the physical requirements, the website ([www.defencejobs.gov.au/fitness](http://www.defencejobs.gov.au/fitness)) has plenty of information on exercising and developing a fitness routine. Keep in mind that if you're after certain positions outside the scope of this article, such as Navy Clearance Diver, you may have to attain a higher level of fitness before your application will be considered.

Aside from fitness, you need to be at least 17 years of age and have either Australian citizenship or, if you're presently ineligible for citizenship (i.e. because you're a fairly recent migrant), permanent residency. You will also need to undergo a background check and a medical examination.

For most military careers, education requirements are basic – you'll need to have passed year 10 English and mathematics. Some positions may also require a pass in science. If you haven't completed year 10, there are alternative pathways available. See the vetassess website ([www.vetassess.com.au](http://www.vetassess.com.au)) for more details.

Keep in mind, when you sign up to the Australian Defence Force you're agreeing to meet their standards and expectations. During Basic Training, you can apply to leave, but after Basic

**...when you sign up to the Australian Defence Force you're agreeing to meet their standards and expectations.**





Training a minimum length of service will apply. You will be subject to military law. If you're given an order that may put your life at risk, you still have to follow it. You may have to work unusual and undesirable hours without overtime or penalty rates. You will constantly have to acquire new military and trade skills. There are dress and grooming standards. In short, our point is that joining the military is something you have to give serious consideration to. Don't jump into it lightly.

## The Australian Defence Force and studying

When you join the Australian Defence Force you're obligated to keep training throughout your career in military and trade skills, but you'll also have the option to study at university. For certain study paths, the Australian Defence Force offers 'sponsorship' deals – you sign up to the military and they'll pay you to study, starting at a fairly low amount in your first year and reaching a respectable figure (for a full-time student, at least) by your third year. They'll help you out with your HECS-HELP contributions and you'll get free medical and dental care if and when you need it. During semester they'll leave you alone, but when your studies are over for the year you'll be training. If you want to join the Australian Defence Force but are yet to graduate school (or are working towards your undergraduate degree, as the Australian Defence Force also sponsors postgraduate students), it would be worth your while checking out this option, as when you eventually graduate you're guaranteed an officer's job in the Air Force, Army or Navy and a good income. For more information on becoming a sponsored university student, point your browser in the direction of [www.defencejobs.gov.au/education/university/SponsoredUndergraduate.aspx](http://www.defencejobs.gov.au/education/university/SponsoredUndergraduate.aspx).

The above deal is allows you to study at any university, although is very much dependent on what you want to study, but you can choose to apply at the Australian Defence Force Academy,

which is tied into the University of New South Wales and situated in Canberra. Students undergo officer training and complete their academic studies concurrently.

### Basic training

As we've repeatedly mentioned, when you join the Australian Defence Force you're a soldier/sailor/airman/airwoman first and specialist second. Everyone who joins the Army has to complete soldier training. Everyone who joins the Air Force has to complete airman/airwoman training. Everyone who joins the Navy has to complete sailor training and those who wish to go on to fulfil positions such as Information Systems Submariner have to undergo submariner training too.

Everyone who joins the Army will complete Basic Training at Kapooka in NSW. Basic Training covers pretty much what you'd expect – the basics of weapons handling, field craft, first aid, night

fighting and physical training. Following Basic Training, which lasts 80 days, you'll undergo Initial Employment Training, which is when your education becomes specialised towards what your future job will be.

Not far from Kapooka is RAAF Base Wagga, which is where the Air Force delivers airman/airwoman training. Training lasts ten weeks and covers both the practical and the physical. You'll undergo physical training and weapons instruction, but also learn about Air Force history, traditions and military law.

The 11-week sailor training course is provided through the RAN Recruit School in Victoria's Mornington Peninsula. Trainee sailors cover, among other subjects, first aid, weapons handling, survival at sea, basic seamanship (think steering the ship) and, perhaps wisely, 'living in communal harmony'.

## Technology jobs in the Australian Defence Force

As noted earlier, the Australian Defence Force's three branches each offer technical jobs. You can enter technical positions in one of two ways – either come with an existing qualification (the Australian Defence Force will stipulate which qualifications they accept for a given position) or undergo training with the Australian Defence Force.

If you're seeking employment within the Air Force, some of the technical positions currently available include Aerospace Engineer, Air Surveillance Operator, Airborne Electronics Analyst, Airfield Engineer Officer, Avionic Technician, Communication Electronic Technician, Communications and Information Systems Controller, Electrician, Geospatial Imagery Intelligence Analyst, Signals Operator Technical



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The Army, specifically the Royal Australian Corps of Signals, offers positions including Communication Systems Operator, Information Systems Technician, Multimedia Technician and Telecommunications Technician. Again, the responsibilities of those who take up these positions are varied. Information Systems Technicians, for example, are responsible for setting up and looking after LANs and WANs, taking care of whatever software, hardware and network issues arise and maintaining IT security. Conversely, a Multimedia Technician spends his or her time producing DVDs, presentations, photographs, Psyops products (read: propaganda) and websites.

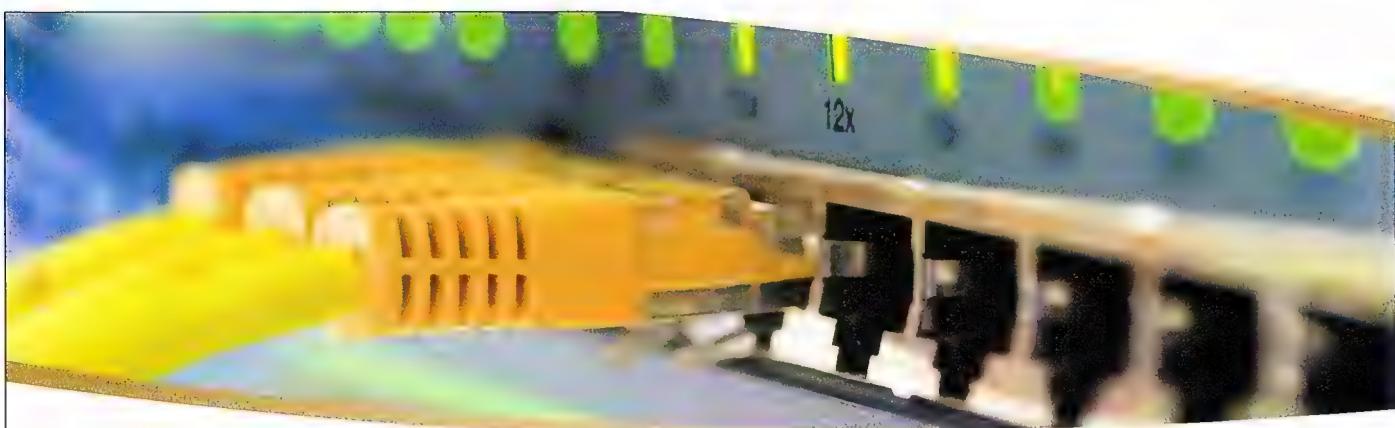
Finally, the Navy's list of technology positions includes Communication and Information Systems Sailor, who are responsible for everything from administering networks to communicating by Morse code while still fulfilling the responsibilities of regular sailors, such as joining boarding parties and fighting onboard fires. The Navy also has Cryptologic Systems Sailors and Communication and Information Systems Submariners.

## Reserves and other options

If you're not sold on the idea of a full-time career in the Australian Defence Force, there are a couple of options available. For those about to finish Year 12, there's the new Gap Year program ([www.defencejobs.gov.au/ADFGapYear](http://www.defencejobs.gov.au/ADFGapYear)). Es-

sentially, the Australian Defence Force Gap Year program allows you to spend a year between finishing secondary school and starting tertiary studies with your chosen branch of the Australian Defence Force. The program is commitment free – if you don't like it, you're under no obligation to pursue a military career – and, best of all, you get paid for it. The exact nature of how the placement program works, including the ability to walk away if you decide military life is not your idea of a good time, differs from branch to branch. And then, of course, there are the Reserves. Each branch of the Australian Defence Force has its Reserves, with the Army Reserves being by far the most numerous. Reservists are, of course, part-time soldiers. They are men and women who work and/or study. Many of the opportunities and benefits available to full-time soldiers are available to Reservists, including the tax-free pay. Keep in mind to get those benefits, you do have to fulfil certain requirements. In the Army Reserves, you'll be required to spend an evening a week with your local unit, go away one weekend a month and occasionally go on weeklong camps or large scale exercises. Some local units will occasionally offer folks who aren't yet 100 per cent sure if they want to commit to the Reserves the chance to go away with them for the weekend to observe and participate in exercises.

There's a lot on offer in the military, but a lot will also be asked of you. But for some, that challenge is what it's all about. ☺



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# GAMEPLAY

GAMES, GAMING AND FILM COVERED... ATOMIC-STYLE

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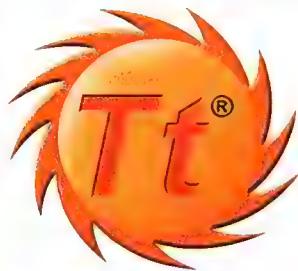
This month we kick off with an in-depth look at a new take on the RTS genre, with Ubisoft's R.U.S.E. Find out all about the tech behind the game, and the strategy behind the strategies.

Then we take a look at the mod scene, with the Half Life 2 mod Research and Development;

you'll also find a handy list of the latest patches at the time we went to print.

Then, our reviews and previews. There's a lot of Nazi killing, with Order of War, Wolfenstein and Europe at War; modern warfare from Operation Flashpoint 2; and some future wars in the shape of Starcraft 2's singleplayer campaign and a sneakpeak at Halo 3: ODST.

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Axis defending their Headquarters after an air strike.



# R.U.S.E.

If Poker is the new black, then Ubisoft's R.U.S.E. is bringing the black to realtime strategy. Because when Seamus Byrne goes black...

**S**ome ideas seem like they should have been explored years before they appear. It's like someone has been playing a cosmic Jedi mind trick, forcing us all to ignore the obvious until it sits in front of our eyes. Spend a few minutes exploring what R.U.S.E. (let's go with just RUSE from here on, though) is bringing to the real-time strategy genre, and you will understand what we mean.

We're getting close to twenty years since the RTS first appeared, and the team at Eugen Systems and Ubisoft wanted to bring something fresh to the space. Inspired by a mix of sources from outside the videogame arena, RUSE aims to be a World War II RTS that puts information warfare at front of stage. As the name implies, clever use of deception can be key to winning the day.

"Sun Tzu and his Art of War were a great inspiration for the project, as we want to make a game where deception is a weapon," says Mathieu Girard, Senior Producer on RUSE. "Poker was also a great inspiration, both for the visuals and the gameplay, as it is the game of bluffing. For instance, unit concentrations are symbolised by poker chips stacks, the higher the stack, the stronger the army. So when you move a large army, it's like pushing in your chips when making a bet in Poker."

"We also did not want to have a classical fog of war in our game. You see all the enemy units but you don't know their types, you don't know if they're real, and some of them might be hidden," says Girard. "This is very reminiscent of the flop in Texas Hold 'Em. You have part of the information and you can think about probabilities, but assumptions must be made so you can still be fooled and bluffed."

As part of the layer of ten deception skills that give this game its name, you can create false information (decoy units and fake buildings), hide information (camouflage units, your base), or steal information from the enemy (monitor the orders he gives to his units). More Ruses will be announced as we approach release around March 2010.

World War II makes a lot of sense for these



**RUSE**

**SPY PLAN**

All unidentified units are revealed in the sector.

Units created by the player will remain hidden from the enemy detection system as long as they do not leave the affected area.



You have room to use your own ideas, but your mission objectives will reflect pivotal events...

ideas. This was the era when the information of war was going wireless, and information warfare began to emerge. Cracking codes, dropping fake paratroopers, allowing false information to leak – all meat and potatoes stuff to operational commanders in the forties.

The game will actually place you in genuine battles of that war, and the game aims to get in-game commanders to use strategies and tactics like they did in the real world. You have room to use your own ideas, but your mission objectives will reflect those of these pivotal events in the actual war.

It was also an era filled with units we know

very well, and the developers have not only offered up 200 unit types for players to control, they have also built a new engine to offer massive environments to fight in.

### IRISZOOM

"We wanted to have huge battlefields with lots of units to control so you feel like the general," says Girard. "This is powered by a brand new technology called the IRISZOOM engine. It is basically like Google Earth in 3D and in real-time."

Watching the game in action, you can rapidly

zoom from single unit views amongst trees or city blocks out to expansive regional views that show the grand sweep of a major encounter, with stunning 3D terrain. Even aircraft sweep across the landscape just as you would think they should if they were closing in for the kill.

Stylistically, when you push out to this maximum view, the world itself changes into a war room perspective, with the map seamlessly becoming part of a table with all the hallmarks of a real war room around the edges of the perspective view onto the live field of play.

"Since we want the players to feel like true





## The Tech of IRISZOOM

There isn't much information about the IRISZOOM engine, which is the new technology under the hood of RUSE. Add some awfully vague statements like its ability to "handle a billion polygons" and we could just dismiss this as living in the land of FUD. But seeing is believing, and it's clear there is a stunning number of polygons being rendered here, with smooth yet rapid zoom capability to quickly move between god view and unit level interaction. This looks and feels like nothing we've seen before.

Data streaming is playing a big role here with a database of textures and models being rapidly accessed and rendered into the geometry.

At this stage final system requirements are yet to be revealed, but we're told configuration minimums will not be "too high". That said, IRISZOOM will definitely take advantage of any number of cores in a multi-core system. And not in an unnatural way that groups tasks by type, either. The engine is built to treat every computational package organically, as discrete small tasks so whether it is physics, AI, or texture, distribution across cores will be about finding available capacity and getting all jobs done quickly.

So be careful not to play RUSE first on your neighbours OctoBeast or you may not want to see it ever again on your dual-core

**The battle is the focus, and units are given appropriately dynamic capabilities...**

strategists, we have given them the tools and environment of a general: a war room with a command table," says Girard. "In most RTS games, your best overview of the battle is a 200 pixel wide square, with some small flashing dots. The battle plan is displayed full screen, with army concentration, arrows to show given orders; everything is clear."

"This design is also used in the single player campaign for the narration of the game," says Girard, "where several general masterminds will collaborate to dominate the enemy."

## Unit management

Immersion is also at the heart of the new engine, and the most obvious change from other RTS is the removal of the traditional interface that would otherwise take up a large portion of the lower third of the screen. The battle is the focus, and units are given appropriately dynamic capabilities depending on exactly where you push them on the map.

With 200 different units across six factions, you'll be using tanks, aircraft, paratroopers,



artillery, and plenty more. While units are historically accurate, it seems the developers have tried to give each faction — such as Russians, British, Germans and Italians — their own speciality. In another recent interview, Girard suggests the Italians (not exactly known for their raw strength in that war) will have the ability to churn out a lot of ships, giving them a Zerg-like flavour in sea combat.

"Some units are obviously more adapted to kill others, but the environment gives you an edge to change the balance of power," says Girard. "For instance, when infantry units come into close contact with tanks, from the corner of a city block for instance, they can use sticky bombs, bazookas, and they will destroy that tank outright, while they would have been slaughtered in the open plain."

Another example is the power of positioning troops inside forests, where they receive a 4x ambush bonus.

"There is a whole gameplay mechanic around the road system, which is used by light units, supply trucks," says Girard. "It is critical to control and protect the roads to protect your economy and reinforcements, just as it is very rewarding to harass enemy supply lines with hit and run tactics."

## Human to human

With deception at its core, it makes sense that a game of RUSE should be inherently more fun when taking on a human challenger. So how much changes from single player to multiplayer warfare? Girard points out they actually had extra work to do to ensure the AI could be an appropriately ape-like opponent.

"The game experience will be very close, as the deception skills you learn in the SP campaign will be usable in multiplayer, and we had to teach the AI how to be 'fooled' by the player actions," says Girard.

The AI is actually divided into tactical sub-AIs, like a set of generals managing their troops in the field. One manages economy, another the troops, and another even looking for best terrain positions. The AI will use deception too, so it is a



Some Enemy units under spy plan.



At long range, Priest tanks are very effective against buildings.

fertile training ground for facing a live opponent.

"But nothing beats bluffing a true human, and some beta testers have already created cool combinations," says Girard. For instance: camouflage a hidden forward base next to your enemy, add Radio Silence to produce invisible units, and now you can strike him swiftly... unless he has used some recon or counter Ruses!"

That last point is where we feel more excited about this title than any other RTS for quite

some time. In a genre where multiplayer matches often proceed to an obvious and inevitable conclusion after just a few minutes of play as one player gets the upper hand, RUSE could deliver tools that actually turn the tide through smart human decision making. If you can turn the tide against the odds through smart use of deception, that would be a deeply satisfying victory — or a humiliating defeat.

As for modes, all we know so far is a Skirmish mode will feature one vs one and four vs four warfare. Any faction will be able to fight any other.

We have seen more than one attempt to make significant adjustments to RTS gameplay and interface, and few have delivered successfully on their ideas. But RUSE feels different. There is a sense of polish, and natural flow, to the way the interface operates. And the basics of what makes RTS good are still firmly in place.

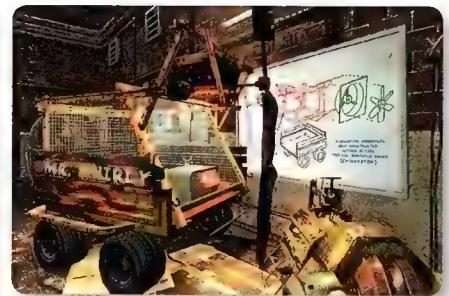
"I think RTS players will find that they have the tools to become true strategists for the first time," suggests Girard. "A battle plan to understand what is going on, mass unit combat, large scale battlefield, deception tools to outsmart their opponent, taking advantage of the environment."

"On the other hand, they will also find everything they like from classical RTS: selection schemes, economy and production of units, campaign, multiplayer, etc."

If all that turns out as intended, there's no question: Ubisoft will have a winner on its hands.



# MODIFICATION



# Research and Development

There's a lot of life left in the Half Life 2 modding community!

The introduction of the Gravity Gun and some great physics in Half Life 2 really sparked a lot of imaginations. Many mods have tried to make the most of these excellent tools, but none can stack up against Research and Development.

Made while the mod's creator was learning his way around level editing, R&D features some of the best level design we've seen in even a retail game, let alone a mod. It's packed and detailed environments make the Source engine look totally new again. And then you get to the puzzles...

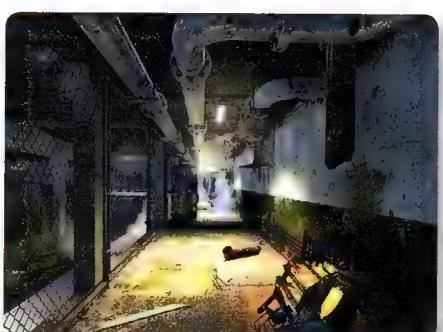
There's no gun-play in R&D – you're a survivor of an antlion outbreak (the big bugs from Half Life 2), and all you've got to rely on is your own two hands (and maybe the gravity gun later in the three hour run-time of the game). The puzzle solving is brilliantly done, requiring you to take note of the environment (hints are hidden all around on notice boards and posters), and to think very much outside the square in some instances.

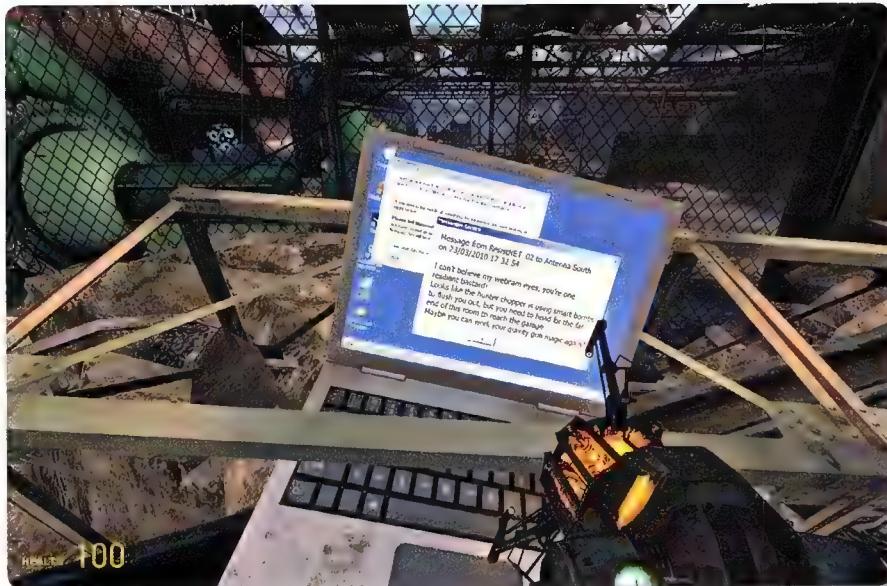
The puzzles are also varied; you might be called upon to overload a crane to make it topple, or have to use pheromones to lead antlions through deadly mazes so they can attack vigilant guards.

Finally, R&D is out and out funny. It's packed with scripted set-pieces that advance the story or simply entertain, and that's not even including the Rube Goldberg-ian fun of constructing elaborate traps for unsuspecting foes.

There are some bugs, especially in regards to the triggering scripted events, but overall this is as polished as any game you'll play this year.

Download it here: <http://www.moddb.com/mods/research-and-development/news/research-and-development-released>





Its packed and detailed environments make the Source engine look totally new again.



## PATCH notes

The month's essential patches.



Warcraft 3 Patch v1.24b

Mass Effect Patch v1.02

Goldeneye: Source Patch v3.1 Beta

Warhammer Online Pre-Patch v1.3.1

World of Warcraft Patch v3.2.0 to v3.2.0a

Wolfenstein Dedicated Server Patch v1.1

Wolfenstein Patch v1.1

Blood Bowl Patch v1.0.1.7

The Sims 3 Patch v1.4.6

ArmA 2 Patch v1.03

Vampire: The Masquerade - Bloodlines Unofficial Patch v6.4

The Witcher Enhanced Edition: Directors Cut Patch

Fallout 3 Patch v1.7

Spore Patch v1.05.1

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Life's Good



# Halo 3: ODST

The Chief ain't nowhere to be seen in the latest Halo!

**H**alo: ODST is set in between Halo 2 and 3, and is structured around the efforts of the ODST – Orbital Drop Shock Troopers – to infiltrate a Covenant battleship. Of course, things don't go quite to plan, and you and your squad end up on the ground, separated, and up against the full might of a Covenant ground invasion.

Like all of the Halo games, ODST opens from immediately from your PoV. The main difference is that you are not some super soldier in God-like power armour - you're just a soldier, and rookie member of your squad at that. And speaking of your squad, the voices will be familiar to Firefly and Halo 3 fans - Nathan Fillion voices the squad leader, Adam Baldwin is the heavy support dude, and the tech guy of your unit is Alan Tudyk. Battlestar Galactica fans aren't left out, either – your squad is working with an ONI agent played by Tricia Helfer, the sexy blonde toaster Number 6.

The game moves quickly from there to an orbital drop, the specialty of the ODST. You get on board a one-soldier pod, and you're violently launched toward the Covenant vessel. You have camera control at this stage, but the buffeting ride makes getting a solid idea of what's happening tough; still, what you can see is pretty damn epic. There are hundreds of other pods, all screaming planet-side, accompanied by the chatter from your squadmates and mission control. The whole feel of the game is immediately very different from any previous Halo experience.

For one thing, when you wake up after the

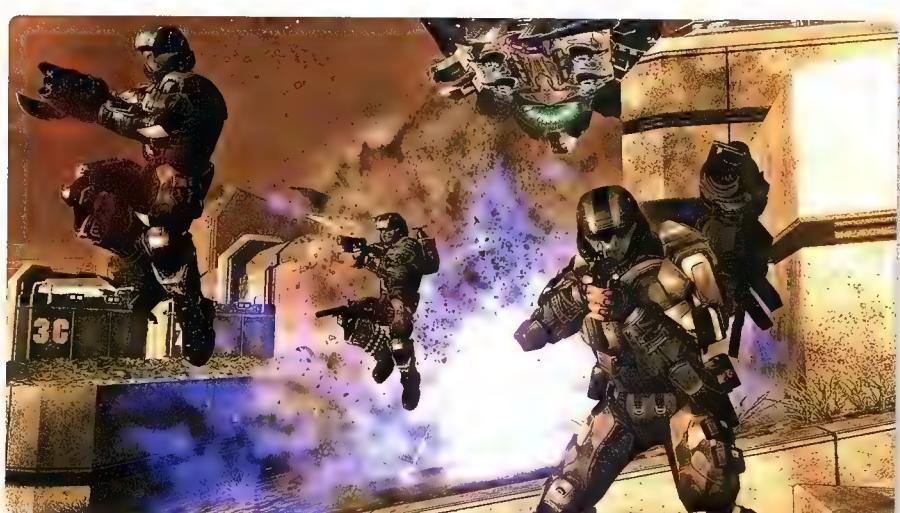
drop has all gone wrong - and six hours after it's gone wrong at that, you've got to free yourself from your pod. It's hanging above a deserted street, and it's bit of a drop. But this is Halo, falling doesn't... OUCH.

In fact, falling even a short distance does hurt, and the next thing you spot is a now shrunken health bar. Energy shield? The ODST don't get to play with anything that fancy. Another feature taken away in this game is dual-wielding, which we found out the hard way in our multiplayer session.

What they do get, however, is a very sexy bullpup SMG (which in action is kind of a cross

between the SMGs from Halo and the good old Assault Rifle, complete with a medium zoom) and very functional night-vision. The ODST often take part in stealth ops, so NVG is a must. In game it ramps up the light levels and gives everything a faint outline, especially important gear and weapons.

Since you're all alone, linking up with your unit, or even whatever's left in orbit from your strikeforce, is the most important thing. We only had limited time with the campaign, but it looks like the game operates on a hub model - the central part of Mombasa is where you start, and there are various areas, with attendant





missions, radiating off of the central area.

One thing I asked Curtis about was the game's engine, and if it is basically the same as Halo 3 or more heavily modified. There are some tweaks, he said, "but the real advantage is that the designers now really understand the tools. So the environments are much more open and far less linear, and we make a lot of good use of lighting and environmental effects."

The hub-based nature of the game isn't the only gameplay change, either. As you progress through the city, you'll find evidence of what your squad has been up to, and these happen as in-game events to fill in the missing six hours. So, you might find a demo-charge, and that opens up a sequence where you control the squad's heavy weapon specialist as he blows a bridge – and this is set two hours after the drop.

"All the game's action is far more human, and more human in scale," said Curtis, "so we wanted to enforce that you really aren't alone. You're not like the Master Chief at all, and you are a part of something greater." Essentially, whereas Halo's central relationship was between a super-soldier and an advanced AI, ODST's is about the simpler bonds between fellow grunts.

Elite grunts, but grunts nonetheless.

## Multiplayer: welcome to the Firefight

Our time in the single-player game was limited, but we did get to spend about an hour blasting away in the new Firefight multiplayer mode. It's a co-operative set up, which places you and your squadmates in a level with ever increasing waves of Covenant baddies. It's kind of like Left 4 Dead's Survival mode.

You have a limited pool of lives that you all share, too, so teamwork and shepherding of resources is paramount. Grenades are a real equaliser here, but then so are the skills of the Covenant on harder settings. With each new wave they learn new skills, like always dodging grenade blasts. Each wave in each iteration of the game is different, too. The action rarely lets up, and the ever-changing mix of weapons and enemies makes for countless tactical challenges.

Halo 3:ODST will ship with a second disk that has all of the so-far released multiplayer maps, as well as three brand new maps.  DH



### Xbox 360

**Developer** Bungie  
**Publisher** Microsoft  
**Website** [www.bungie.net/Projects/odst/](http://www.bungie.net/Projects/odst/)



Good voice cast; excellent use of older engine; engaging new multiplayer



Not a lot new in terms of enemies [that we saw]



#### Anticipation rating

We're looking forward to our first drop – simulated...

**83%**



# Order of War [PREVIEW]

A bread and butter WW2 RTS, but is it a tasty treat?

**F**or all the razzle-dazzle and flash of a game like R.U.S.E., it's kind of refreshing to see such a solid and workmanlike game as Order of War. Sure, you could say that World War 2 has been done to death, but really, it's a classic setting that really suits the tenets of RTS warfare. I mean, people aren't tired of sci-fi RTSs, are they?

Our preview code was limited to some single missions and two three-mission campaigns, one each for Germany and the USA, but it's more than enough to be indicative of the larger product, and already the code is bug-free and very slick. It's also great to see a game with the full range of graphical options, letting you scale the game up to take true advantage of a beefy system. On our 4870X2-powered NRG gaming beasts Order of War is looking splendid, with excellent detail on vehicles, infantry and battle damage.

Order of War operates at the platoon/squadron level, with each 'unit' being about 30 men or five tanks. One to one or squad-based wargaming is all well and good, but the platoon is really the most basic building block, and Order of War is more than capable of putting you in command of entire battalions of infantry and armour. The management of your troops is also very basic – the AI makes most of the decisions, leaving you to worry more about broad positioning and tactics, rather than telling

individual units to fire specifically.

Unit control, therefore, is pretty simple, but quite precise for all that. To move a unit, you right-click where you want it to go, then swivel the unit's facing. Release, and your unit is on the move. Apart from telling units to occupy buildings or fortifications, that's about it! Order of War is not at all about micro-management; some will find this annoying, but it personally it adds a lot more realism to the game. Moving even company-sized blocks of troops is simple and elegant.

Given the size of each unit, it can also take a while to entirely knock a platoon or squadron out, so battles tend to play out a little more slowly. When two infantry platoons meet, they'll go to ground and exchange long range fire while setting machine guns and bazookas – it might take a couple of minutes for a clear victor to emerge, so again you're not needing to manage every contact or engagement. Order of War is more about the sweep of battle, about the timing of an assault or the decision of when to throw in reinforcements.

And these are important decisions; the second battle of the American campaign puts you in command of about two dozen tanks, ten tank destroyers and couple of infantry companies. Your mission is to overcome dug-

in German troops and assault guns. A tank rush would be fatal, due the German infantry's excellent anti-tank capabilities, so you need to be cautious, but still aggressive enough to force the issue. Proper tactics (support armour with infantry, preserve your tank destroyers to deter enemy armour counter attacks, fire and movement) will save the day; tank rushes will leave the field strewn with Shermans and dead GIs.

The campaigns at this stage are linear, but a system of persistent unit upgrades allows a degree of customisation. Multiplayer will be present in the final game, but we're going to have to wait for full code before we give that a try – but we're keen to do it, and very keen to see all that this game will have to offer. F **DH**

PC

Developer Wargamer.net  
Publisher Ubisoft  
Website [www.orderofwar.com](http://www.orderofwar.com)

✓ Good unit management;  
great camera controls;  
awesome graphics

✗ Units feel a little samey;  
lack of campaign control

**Anticipation rating:**  
Reminds us of the classic  
Combat Mission, and that's  
not a bad thing at all!

**88%**





# Operation Flashpoint: Dragon Rising [PREVIEW]

The classic military sim is back, from a new publisher. But how does it stack up against stiff competition from ArmA II?

**B**ack in the day, the original Operation Flashpoint was a true revelation. It was a shooter, but it let you drive cars, fly attack helicopters, and level villages with artillery. It was a shooter, but it was as deep and involved as a serious flight sim. It was a shooter, but if you came to with ballistics experience only from a game like Half Life, you'd be without a clue. Just sniping someone from a few hundred yards was a challenge, as you had to take into account wind, fall of round, and any number of other ballistics factors.

It was glorious, and though flawed, it remains a gem in the hearts of many gamers.

After nigh on a decade, the game is back, with a new subtitle: Dragon Rising. Once again, some small, fictional island nation is in trouble, and once again it's up to an elite American taskforce of air, land and sea elements to sort it out.

Our preview code is limited to two levels, but even from the game's UI, we're impressed. It's sleek, classy, and backed by some good music. Sadly, the UI and its menus also reveal some of our worst fears.

OFP: Dragon Rising is that most worrisome of

PC titles – one that's also coming out on console. This is driven home by our preview code's habit of flashing up an Xbox controller as the game's load screen... we love our 360, but this kind of thing just makes us feel dirty.

Even worse is the fact that Dragon Rising has fiendishly limited graphics options – screen res and gamma are about it. Anything else you'll have to force from your graphics driver of choice.

Those limitations aside, however, once in-game, it's a totally immersive experience, and completely free – so far, at least – of the same kind of bugs that plagued the launch of ArmA II. Your HUD is very limited, and on higher difficulty levels it practically disappears; for this reason, a lot of your in-game cues come from real visual indicators. The game supports an impressive draw distance – over 30 clicks – scopes and binoculars important tools for spotting enemy activity or even just planning your approach to an objective.

You order squadron and squad mates using a simple radial menu that projects a cursor over the environment. In a few clicks you can tell your men to flank left, to only fire if fired upon, and to move fast. The feedback you get from

squadmates is pretty clear, too, and to make another ArmA II comparison, pretty much bug-free already.

And you'll need all those orders and callouts – Dragon Rising is deadly, and the enemy AI pretty clever at using terrain and creating overlapping fields of fire. It can even lay a pretty neat ambush – as we find out to our chagrin, and our AI squadmates' regret.

We've not had a chance to look at multiplayer, yet, but we're confident that if the rest of Dragon Rising can reflect the polish of these two levels, the game's going to be a winner. It's detailed, responsive and very demanding. Bring on the full release! DH

PC, Xbox, PS3 (previewed on PC)

Developer Codemasters  
Publisher Namco Bandai  
Website [www.codemasters.com/flashpoint2/](http://www.codemasters.com/flashpoint2/)

✓ Smart AI, real-world locations, challenging missions.

✗ Lots of controls to master.

**Anticipation rating**  
We've stopped playing the full version of ArmA II in favour of this preview. 'Nuff said.

**89%**





# Starcraft II: [PREVIEW]

## Wings of Liberty

Hands-on with Stacraft's new singleplayer campaign.

**W**hen I first previewed Starcraft II's multiplayer action back in Issue 103, the game was as solidly built as the nearest all-brick steakhouse, and apart from a few niggles was masterfully well-balanced. But for some people multiplayer is only a small piece of the game (if indeed it registers at all).

Blizzard has decided to mix things up a lot with Wings of Liberty, and rather than including all three factions' campaigns they've chosen to focus completely on the Terran campaign alone. This might seem to be a step backwards (and for those who aren't quite as enamored with the plucky humans they might indeed hate it), but it places a razor-sharp focus on one side – and their story. I spoke to a dev at a recent event about the reason behind this, and he explained it as "there simply would not have been enough space to tell a cool story... enough space for a meaningful choice."

The singleplayer campaign picks up some years after the events in the Brood War expansion pack, reintroducing Jim Raynor as the leader of the Terran resistance against the Emperor (Arcturus Mengsk). His vessel and

home is actually a Battlecruiser he stole from Mengsk, and in-between missions it acts as both a way of navigating the story of the game and a way of establishing a connection with the characters. You can chat to a battle-suited Marine on the bridge, chat with Mercenaries in the bar, talk about calculators with the plucky lab technician in the science bay or spend some cash on persistent upgrades with the lads in the engineering deck. Every choice you make on the ship affects the campaign from that point forwards.

Each mission is presented to you as a request by a planetful of colonists, a treasure-hunting expedition from your old war buddy or simply as a result of the reinvigorated Zerg attack on mankind. The aggressive beasties have come back in force, and with any renewed Zerg presence the Protoss are sure to follow – throwing the whole universe into chaos once again. You're given a choice of missions to complete at any given time, and while the ultimate storyline is linear the order of the missions is not. As each mission unlocks

one specific and unique unit (and pays a different amount of money), and is crafted to take advantage of the strengths of that particular unit, the choice really is up to what seems most interesting or useful at the time. Units that couldn't make it into multiplayer (simply because they're not used) are the stars of the singleplayer campaign, bringing back Medics, Firebats, Goliaths and even Wraiths. Each have been tweaked to make their particular abilities even more specific.

The challenges presented in each mission are wildly different to the usual RTS fare; like a mission to a world to mine crystals located on low-ground with a base on high-ground, and a five-minute looping cycle cleansing anything on low-ground with burning hot lava. That one's tough.

Included with the campaign will also be achievements that give amusing or difficult goals for specific difficulties, as well as plenty of hidden content that can only be found by searching for it. This really does seem to be a singleplayer campaign done with impressive style, and will surely tempt those looking for more story than the typical 'build-base-kill-them-rinse-repeat' RTS games of yesteryear.  JR

PC

Developer Blizzard  
Publisher Activision/Blizzard  
Website [www.starcraft2.com](http://www.starcraft2.com)



Very polished graphics;  
enjoyable challenges



Some levels are repetitive,  
sound can use some  
improvement



**88%**

Anticipation rating  
It's Starcraft, of course  
we're looking forward to it!

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# Wolfenstein

How can you go wrong with Nazis, the occult, and lots of gibbing?

There are few games that have as long and venerated a lineage as Wolfenstein. For many gamers, it rates as one of their first experiences in the visceral world of the first person shooter. That sense of nostalgia is not something to take lightly – first games are not unlike someone of a previous generation knowing where they were when Neil Armstrong landed on the moon.

Nostalgia is a harsh mistress, however. Can Raven's latest idTech4-powered iteration provide solid action, while still pleasing the old-school fans hankering for a new PC classic?

## Console-port-tastic

Wolfenstein and PC gaming goes hand in hand like bread and butter, but this time, Wolfenstein's coming out across all the major gaming platforms. And it shows, in all the wrong ways.

If you're a gamer and upgrader worth your salt the first thing you'll do in any game is dig into the graphics options to make sure your new game is going to look as shiny as your practically nuclear-powered rig can make it. And that's going to be your first big disappointment in Wolfenstein, as there's barely any options to tweak!

You can bump graphics detail up and down between three settings in about seven variables, and the only one that really speaks to the PC's power is Anisotropic Filtering – we don't even

get to play around with anti-aliasing! This would be okay if the game had some native hi-res texture packs to make up for it, but we're playing with the same files that the console-crowd will be tooling around in.

The graphics aren't the only are of the game that suffers from the port. The main interface is very much designed with a thumb-stick in mind, rather than the more elegant mouse (sorry, console fans, it's just true); it takes about

three times more clicks than you'd expect to even get into a game, and when you are in-game, don't even think about quick-saving. Checkpoints and auto-saves are the order of the day, but there do seem to be a lot of them, and we've not found it too onerous relying on them. Before each big set-piece there's always a save, and the discrete nature of a lot of the encounters allows you adequate time to recover from each firefight.





## Killing Nazis for fun and profit

All of that whining aside, there's a lot to like about Wolfenstein's single-player. It kicks off with a stunning CGI intro, and then drops you more or less straight into the action. You play long-time protagonist BJ Blazkowicz as he attempts to fathom the dark dealings of the SS as they in turn seek out the secrets of the mysterious power known as the Black Sun.

The plot is pretty much Raiders of the Lost Ark on crack, and with even more exploding bodies! In a lot of ways, it's pretty much bang on what you want from a Wolfenstein, though this time the focus on occult action is much heavier.

Even BJ's getting in on some occult loving thanks to the acquisition early in the game of a Thule Medallion, an artefact of a bygone age that lets him see behind the Veil and into a shadowy otherworld. This is the prime mechanic of the game, and you'll swap into Veil vision to see secret doors, enemy weakpoints, and use powers like slowing the flow of time to take advantage of slow-mo enemies.

It's a pretty neat effect, too. In the Veil, your focus on the world is sharper, and you see everything in ghostly shades of blue, while strange creatures and dark winds flow through this otherworld. Using the Veil runs down your Veil energy, as do the various powers, but there are many Veil fountains throughout each level, so running out of energy is more of a hangnail than a fatal error.

But all that fun boils simply down to one thing – killing Germans – and for all the added colour



of the Veil, Wolfenstein's gameplay still seems a little one dimensional.

Part of this is the level design, which tries to make you feel like you're in a big world, but is in fact really quite linear. There's lots of ammo, more than enough Veil energy to harvest, and since a lot of the action takes place in cramped areas, explosives can be very powerful.

There's the usual variety of real-world weaponry, and things get even easier when you start picking up some of the super-science weapons that the Shock Troopers carry. To be honest, most of our deaths were from our own grenades, which seem to have an annoying knack of finding things to bounce off then land back at our feet.

It all adds up to a singleplayer experience that is fun enough, but only just. Surely multiplayer will be our savior?

## War is a team effort

In some ways Wolfenstein's multiplayer is a serious step backwards. Its graphics are, well, lacklustre at best (it's the same engine, but tweaked for performance rather than quality),

and why anyone, let alone a dev like Raven, would bring out a game with 12 player cap in this day and age is beyond me. On the other hand, there are some hints of innovation, or at least paying attention to what a good online game should be, that it'll likely draw you back more than the adequate singleplayer campaign.

Multiplayer revolves around class-based gameplay (Soldier, Medic and Engineer), in three modes (Team Deathmatch, Stopwatch and Objective). There's fun to be had, but you can't help but feel that few more players, or some better animations or textures, would really lift the experience. The ability to buy yourself persistent upgrades between matches is good, but not quite enough to pull Wolfenstein over the line online.

Raven seems to agree, too, as a zero-day patch updated a lot of early issues; the dev studio that made the multiplayer component was laid off at much the same time, too. Yipes.

And we can't really blame them. Wolfenstein has promised so much, and just not quite delivered. It's fun, but it could have been so much more. DH



PC, Xbox 360 and PS3 (reviewed on PC)

**Developer** Raven Software  
**Publisher** Activision  
**Website** [www.wolfenstein.com](http://www.wolfenstein.com)

**Graphics**  
Very atmospheric, but limited in detail.

**Gameplay**  
Fun enough, but plagued by poor AI and linear design.

**Sound**  
Probably the game's best aspect.



**Overall**  
Not the Wolfenstein we were hoping for.

**73%**



# Military History Commander: Europe at War

Would you pay money for a glorified Java app?

Long before I even owned a computer, I was a gamer. But back then, it was all about dingy cardboard boxes with hundreds (sometimes thousands) of counters, and detailed maps all made up of little coloured hexes. It was the golden age of military wargames, and I loved them. But setting them up could take as long as playing the game itself, and of course there was always the common nerd lament – convincing someone to join you in a game that would likely take weeks to finish.

So when I found my first hex-based computer wargame – Operation Market Garden, I believe – I was in heaven.

Military History Commander: Europe at War, appeals to that inner board wargamer. It's a simple, top-down recreation of those classic old wargames – games that were as much about supply and tactical forethought as they were about conquering your foe. The graphics are simple, the mechanics seemingly simple, but from simple systems, complex strategies often form...

Gameplay is a matter of moving about your units on the hex map, extending movement points and attacking adjacent counters. It's not quite rock-scissor-paper, as the game does model supply, morale, terrain and many other variables, but you can usually be certain that a tank attack with proper support will roll right over infantry that's not prepared.

In fact, working out what order your units should attack in is half the game. As units fight, they lose effectiveness, and this counts for both sides, meaning that even a highly successful unit

will need to be rested and resupplied every now and then.

So you can soften up targets with air attacks, but that may well trigger a counterattack from an enemy airforce. A feint from another air unit can draw that attack off, so then you can launch your raid, but then what? Hit hard with your best units – say a tank brigade – first, or continue to soften up the enemy in the hopes that a follow up tank attack can wipe them out? Victory itself can lead



## Real wargaming

The first 'proper' wargame was a learning aid for Prussian army officers in the 1800s. Called 'Instructions for the Representation of Tactical Maneuvers under the Guise of a Wargame', or Kreigspiel for simplicity, this was everything you'd expect, featuring codified rules for movement and combat, and used coloured (red and blue) wooden blocks on the 1:8000 scale map.

The system was backed by such military luminaries as Helmuth von Moltke, and was adopted by most other militaries of the time. It's also still played today. You can learn more at [www.kriegsspiel.org.uk/](http://www.kriegsspiel.org.uk/)



Stateside, but to no avail.

There's a host of multiplayer modes to take advantage of, too, including some of the less glamorous ways to play online. You can play game hotseat style on the one machine, which is always welcome in a turn-based game, and you can even play via email, which is another classic 'serious wargame' touch. Playing by email may seem odd to a twitch gamer, but when turns can take tens of minutes, if not hours, the ability to simply play when you want, and know that you can then fire a turn off to a player anywhere else in the world is pretty neat.

And all of that from what is really a simple Java app!

That simplicity is at the same time a real strength and a bit of a weakness. Sure, Europe at War runs on just about anything – the specs mention Windows 98 and single-core Pentiums! – and will run well. For the notebook gamer crowd, it's perfect (and will make a great distraction on long-haul trips), but at the same time the game can get a little... samey.

Since I am one of those old-school types that still plays the odd tabletop wargame, it's not so bad, but for someone without that pedigree the game could easily seem too simple, and certainly too repetitive. There's likely only so much hex-



clicking an otherwise sane person can handle. But...

Europe at War really is worth getting to know. For one thing, it's pretty strenuous in trying to present historical outcomes, so can be very educational. Then again, you'd expect that from a game that's come out of A&E's Military History Channel! Sure, you can shape your war the way you want, but things happen externally as they historically did, like Italy joining the war, for instance. And the basic combat mechanic is a good illustration of the kind of combined arms warfare that proliferated during World War 2. It's just not very flashy, is all.

If you're looking for a surprisingly deep strategy title that doesn't need you to earn a degree in advanced logistics, Europe at War is a good choice. But if you need a bit of flash with your World War II fare, you may want to look elsewhere. DH

PC

**Developer** Slitherine  
**Publisher** Madman Interactive  
**Website** [www.slitherine.com](http://www.slitherine.com)

**Graphics**  
Simple to the point of plain.

**Gameplay**  
Much deeper than it looks.

**Sound**  
Rudimentary at best.

70  
32  
75



**Overall:**  
An old-school classic that deserves some attention.

to a stalemate, push the losing unit back (and allow you to occupy their hex), or, if the enemy is sufficiently weakened, destroy it outright.

Combined with the hard limit on how many units you can bring to the fight (thanks to the hex system), there are some subtle tactics to keep in mind.

In the larger picture, Europe at War also models a nation's industrial base and research programs. Replenishing exhausted troops takes up industrial capacity, as does recruiting new units – balancing the two can be a challenge. Further, you can also improve your tactical doctrines through research, improving, for instance, tank tactics or anti-submarine warfare.

Finally, there's the ability to recruit Commander units, who will bring particular bonuses when you attach them to certain units.

The theatre of the game is pretty much just Europe and the Middle East. The East Coast of the USA is on one map edge, but I'm pretty sure that's just there to tease anyone taking on the part of Germany. Certainly, in my run through I put a lot of effort into trying to get troops





# Wolfenstein LAN Night

How can you go wrong with Nazis, the occult, and lots of gibbing?

LAN events are awesome fun at the best of times, and last night was no exception to this rule - with twenty Atomicans packed into our gameroom, we had a blast with Activision's latest game, Wolfenstein.

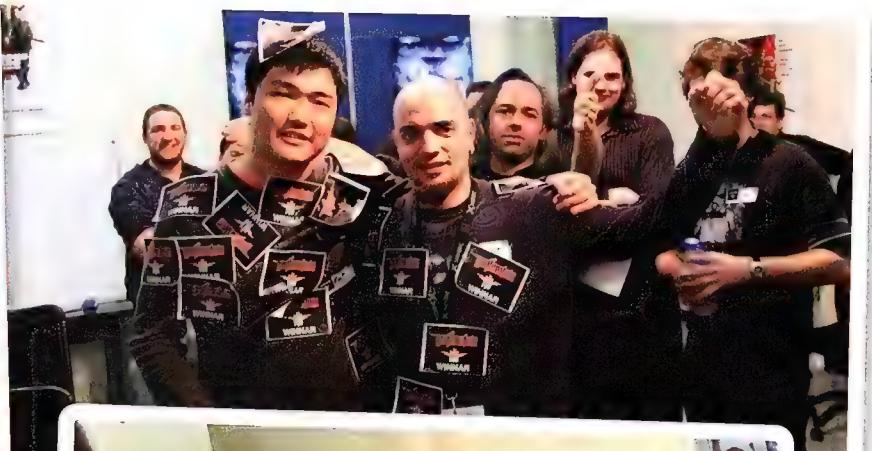
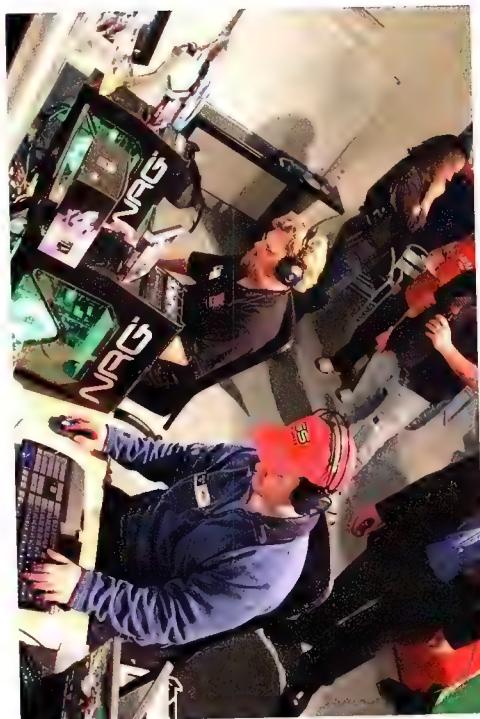
No LAN would be complete without pizza and beer, but while those were supplied in plenty we also had five beastly NRG gaming rigs from Altech fully stocked with the latest Razer gear to give the contestants the ability to frag as well as possible.

Ten teams, five heats, four contestants, two players and one awe-inspiring final round was the order of the night, and two plucky Atomicans won themselves a free sub to the mag!

Not only that, but the awesome dudes at Activision gave everyone a copy of Wolfenstein as they left, so their fragging of evil Nazis could continue long after the Atomic HQ doors had closed.

Thanks from Atomic to all those who came on the night, and we hope to see you again at other events!





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# District 9

Quite possibly a contender for sci-fi film of the decade.

**T**he bureaucrat talks into the camera, explaining an alien gang sign, while a curious alien loiters in the background, looking slightly nervous, and still kind of curious. It's hard to tell which one of the figures is less at ease – the chitinous visitor from another world, or the white-shirted functionary wearing an ill-fitting bullet-proof vest. And it's just one of many wonderfully constructed scenes showcasing the divide – or lack thereof – between what we call human and what we fear for its otherness.

District 9 is that kind of film, the kind that makes you want to wax lyrical about the Kafka-esque overtones, or rave about the subtle and understated performances from a cast of largely unknown, untrained actors. But don't let my intellectualising fool you. As subtle and even lyrical as some of District 9's storytelling is, it still has a lot of balls to the wall action to deliver, some freaky-cool aliens, and some awesome technical production design.

It really is just about as perfect a piece of thoughtful science fiction cinema that I've seen since 2001, or Soderberg's remake of Solaris.

It opens simply, in a faux documentary style complete with interviews after the fact. It's intimated early on that District 9's central character, Wikus Van De Merwe, has been responsible for something big, but we don't learn exactly what, only that it's almost beyond the comprehension of those left behind, like his wife and co-workers. Then we flash forward to Wikus himself, before it all goes bad.

As lead characters go, he's pretty much the ultimate dweeb. Think someone like Ricky Gervais' character from The Office and you're



not far wrong, and it's an interesting choice for someone we're meant to follow through an at times complex plot. But what it does is lend the film an incredible air of truthiness (to borrow from Colbert), and make the character's remarkable journey all the more impactful.

Even more impressive is the fact that Sharlto Copley hasn't really acted before, apart from a small role in Neill Blomkamp's short film Alive in Joburg (which was the inspiration for D9). Sharlto's presence is amazing, at once entirely natural and perfectly intense. In fact, pretty much every performance is note-perfect, especially some of the talking head documentarians that provide the backstory for the shadowy District 9 itself. Blomkamp has extracted some

very nuanced performances, largely through trusting his actors to develop and improvise their characters as they filmed.

Similarly, the choice to keep the film set in Johannesburg, rather than locating it in, say, the usual spot for Alien encounters, the USA, means that D9's tale of segregation, fear of the other and corporate greed has an overwhelming sense of belonging. And it didn't hurt that the crew could shoot the film in real slums and shanty towns. Some audiences may find the South African accents impenetrable, but it really does work to make the film ultimately believable.

But, as good as D9 is – and it is very good – one can't help but come away from the film a little sad, feeling that Blomkamp and producer Peter Jackson lost the chance at something possible even greater. Looking at D9's slick action sequences, remarkable set and effects design, you can't help but get the feeling that if the pair had been able to make Halo, it would have been something truly remarkable.

And yet we should be happy that Jackson felt he had such a talent on his hands he could give him \$30 million to make something else – and something remarkable at that. DH



## DISC OF THE MONTH

This was a hard choice this issue, as there's been some solid releases. So hard, that we've had to split Disc of the Month three ways!

First cab off the rank, is the little known horror western **The Burrowers**. Horror western? Yeah, that's what we thought too, but the film delivers a clever script, some solid performances, and a nice take on the wide open plains of the west. Hint:

they're not as safe as you might think!

Our second choice for awesomeness this month is itself call between two films – **Labyrinth** and **The Dark Crystal** on Blu-ray. Both are excellent prints, with a mess of special features, but in the end **Labyrinth** wins by the length of David Bowie's codpiece.

Finally, we fill out the month with our other favourite genre – science fiction

– with the remastered pilot episode of **Stargate**. This was a show that definitely got better as it went on, but the pilot still has something going for it, and with new effects it stacks up against newer episodes better than ever. Plus, we still have a soft-spot for Space-McGuyver.

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# Life and machines

**Ben Mansill is grateful for everything, but wants more.**

There comes a time in any tech journo's life when writing a retro column becomes appealing. I want to do this because I feel I have stories, insights and perspectives that have accumulated over the years, and I want to share those. For me to do this in Atomic has a karmic inevitability, so here it is kids and oldies. Hopefully in the issues to come I can give some perspective to the relative youngins, while tickling the nostalgia bone for the oldies, all the while thoroughly relishing the chance to have a spill on my favourite things.

To kick things off I'm going to think a little about this amazing technology age -- and that's what it is, that almost all Atomic readers can say they grew up with as it happened, or were born into as it began. We're riding a wave of change and invention that has no equal in all history.

I think we're the luckiest bastards that have ever lived. I'm sure many minds in the past have felt the same way -- being alive when Bach, Beethoven and Mozart were producing musical triumphs must have felt like a kind of pinnacle of civilisation. Standing at the foot of the shiny new Great Pyramid must have imparted a powerful sense that a finality of achievement had been reached and everything before merely led to that moment, and everything past must surely be decline. And on. Pax Romana. The Aztec empire pre-Cortez.

Then you have moments -- breakthroughs, which I'm sure weren't thought of at the time as a plateau, but rather, the dawning of change. A confidence that far greater things had just been heralded, and all the better if, at the time nobody really knew what those things may be, as a moment was happening that handed over ideas and opportunity to anyone inspired by seeing the incredible, and realising it was just a starting point. The industrial revolution. Flight.

Ours is a different kind of era. Not limited by the simple physical world of mechanical devices, of wheels, levers and steam. Ours is powered by the subatomic, by the four fundamental forces of nature. We have materials technology we're only just beginning to understand and exploit, with so much more ahead. We have huge power on tap to feed our devices and take that power with us in our pockets. We have transcended the sci-fi hopes and visions of just a generation ago, FTL excepted.

We live on an Earth with six times the population than was alive two generations ago, and most of them buy a new mobile phone every year, and expect it to be smaller, cooler, sexier and more powerful. And it will be. Hell, I think that mobile phones, *period*, are a damn miracle! We're fed relentless change and invention by industry and research that have no compare, powered by an economy that allows

exponential growth.

Now of course, not everyone gets a kick out of all this, or even thinks about it. For most folks -- why should they? Gadgets are marketed to us as *tools*. Smartphones for better business communication, HDTV because it's prettier, GPS because street directories have always been a pain in the arse.

Then there's folks like us. Atomicans are in tune with both the benefits *and* the way it works. We dig this shit, we get excited about what's in the box and we want to know how it works. Each year we cycle through new CPU and GPU technologies, each a relatively giant leap over the last. Hundreds more transistors in a square inch; though those who have actually seen a genuine bona-fide old fashioned transistor are a dying breed.

What I love about being part of Atomic and knowing you're the same, is that the bigger picture, the perspective, isn't lost on us. We see rapid change, we understand how it happens and have a rough idea of where it's heading, if even in the short term. Equally, I love that we embrace technology for its own sake. Sure, we didn't really *need* that new video card -- but it had more pipelines! And lastly I love

that we play games, which, to me is one of the purest way a human can enjoy technology, appreciating it, understanding what's going on in the background, controlling it while letting it take over our senses.

Perspective stretches further back, though, than last year's model. It's taking a very big step back and understanding that we humans today are no different from the humans of old. We have the same brains and bodies of those who marvelled upon the new pyramid, or heard Bach himself play. Thing is, we're also the same as those who only needed to remember their keys and wallet when they left home, and watched one of a couple of channels of black and white TV at night. And that was only half a lifetime ago. We really are in a powerful new time.

We can stand alone on a grassy hill, in some remote wilderness, enjoying a temporary delusion of solitude and simplicity. But there's no place to go where we're not blanketed by thousands of satellites overhead. Where our bodies are not constantly bombarded with man-made radio waves. There's nowhere the phone can't ring.

And in ten years, every single thing we're dazzled by today will be primitive, slow and embarrassing to be seen with. As if this isn't the best damn time to be alive! ☺



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### HD 4870

**Video Memory :** 1GB GDDR5  
**Engine Clock :** 770MHz  
**Memory Clock :** 900MHz (3.6Gbps)  
**Memory Bandwidth :** 256-bit  
**DirectX® support :** 10.1  
**Bus Standard :** PCI-E 2.0  
**Output :** Dual DVI + TV-out



### HD 4850

**Video Memory :** 1GB DDR3  
**Engine Clock :** 625MHz  
**Memory Clock :** 950MHz X2  
**Memory Bandwidth :** 256-bit  
**DirectX® support :** 10.1  
**Bus Standard :** PCI-E 2.0  
**Output :** HDMI + CRT + DVI



### HD 4670

**Video Memory :** 1GB DDR3  
**Engine Clock :** 750MHz  
**Memory Clock :** 800MHz X2  
**Memory Bandwidth :** 128-bit  
**DirectX® support :** 10.1  
**Bus Standard :** PCI-E 2.0  
**Output :** HDMI + CRT + DVI



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## P193

Motherboard Support	Up to Standard ATX
Expansion Slots	7
Drive Bays	4 x 5.25" Ext, 1 x 3.5" Ext, 6 x 3.5" Int
Cooling System	1 rear 120 mm x 25 mm exhaust TriCool™ fan 2 top 140 mm x 25 mm exhaust TriCool™ fan 1 side 200 mm fan for graphics cards
I/O ports	2 x USB 2.0 / 1 x eSATA / 1 x Audio Set (AC'97/HD)
Dimensions (mm)	514 mm (H) x 205 mm (W) x 590 mm (D)

## P183

Motherboard Support	Up to Standard ATX
Expansion Slots	7
Drive Bays	4 x 5.25" Ext, 1 x 3.5" Ext, 6 x 3.5" Int
Cooling System	1 rear 120 mm x 25 mm TriCool™ fan 1 top 120 mm x 25 mm TriCool™ fan
I/O ports	2 x USB 2.0 / 1 x eSATA / 1 x Audio Set (AC'97/HD)
Dimensions (mm)	514 mm (H) x 205 mm (W) x 507 mm (D)



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